WYO-BEN, INC.

PIT 108T EXTENSION AMENDMENT/UPDATE/PLAN OF OPERATIONS:

PROPOSED PITS (BENTONITE BEDS and STOCKPILE AREAS)	TOWNSHIP	RANGE	SECTION	PROPOSED DISTURBANCE AREA (Acres)	CLAIMS
108T Ext. (F3 BED) Including C.O.P ,T.O.P and HW RED. areas	T43N T43N	R95W R96W	19,20,29 24,25	375.5	Wind 1,2,3,4,23 27, 52
TOTAL PROPOSED PIT and STOCKPILE DISTURBANCE AREA				375.5	

1) C.O.P. = Contoured Overburden Pile – this area may include overburden stockpile area, temporary bentonite stockpiles, camp site, and will be reclaimed as a permanent contoured overburden area once mining is complete to reflect the surrounding topography.
2) T.O.P. = Temporary Overburden Pile – this area may include temporary overburden stockpile area, temporary bentonite stockpiles, camp site, and will be reclaimed similar to the original topography.

Proposed Haul Roads

New Haul Roads HR 26.1 and 26.2 (Short haul roads to service the east end of proposed pit 108T extension.)

746 lineal feet x 60 feet wide = 1.0 acre

Summary of Proposed Disturbance

Total Proposed Pit and Stockpile Disturbance	**375.5 Acres**
Haul Roads Outside of Potential Disturbance*	**1.0 Acres**
Total Proposed Disturbance Area	**376.5 Acres**

LAND OWNER: UNITED STATES GOVERNMENT, WORLAND FIELD OFFICE OF THE BUREAU OF LAND MANAGEMENT

TABLE OF CONTENTS

Page

Pit 108T Extension Amendment/Update Summary…..………………………………1
Form 1 – Amendment Application …….……………..……………………… 3.1
Surface Owner Consent ..………………………………………….…………..... 4
Table 1. Disturbance Acreage by Claim ……………………………………….. 4
Appendix A – Surface and Mineral Rights within Amendment Areas ..………….. 5
Appendix B – Surface ownership and other valid legal estates of record ..…..…. 5
Appendix C – Form C-2 Bearing and Distance Descriptions …………………… 9
Appendix E………………………………………………………….…………… 10
Appendices A and B Map …......................….…...…………..……………….…10.1
Appendices C and E Map …......................….…...…………..……………….…10.2

Appendix D …….…………………………………………… ………………… 11
D-1 Land Use ………… …………………………………… ………………. 11
D-2 Brief History of the Area … ………………………… ………………. 11
D-3 Archaeology and Paleontology ……………………..………………... 12
D-4 Climatology ………..…………………………………………………….. 12
D-5 Geology and Overburden …..…………………..………………………. 14
Figure D-5.1 Major Big Horn Basin Bentonite Formations … …………. 14.1
Topographic Map ………………………………………………………. 14.2
Overburden Laboratory Analysis …………………………………….. 15
D-6 Hydrology ..…………………………………………………………… 17
Table D-6.1 Hydrologic Summaries …………………………………......19
Adjudicated Water Rights ……………………………………………………. 20
Surface and Ground Water Rights..…………………………..……… 20.1
Ground Water/Surface Water Map ………………………………………. 20.2
Hydrology Map …….....…...…………. ……………………………………. 20.3
D-7 Soils……...……………………………………………………………… 21
Appendix D-7.1 Soil Pedon Descriptions …..…………………………….. 33
Appendix D-7.2 Soil Pedon Photographs ………...…………………... … 43
Appendix D-7.3 Soil Pedon Laboratory Results …………………………. 44
Soils Map …….……....…………………………………… ………..…….. 44.1a
D-8 Vegetation……………………………………………………………….45
Appendix D-8.1, Vegetation Summary Tables ……………..…..…………. 48
Appendix D-8.2, Vegetation Field Data Sheets ……………...…………... 52
Appendix D-8.3, Vegetation Aspect Photographs …………………………. 53
Vegetation Map ……..……….………………………………………… 53.1
D-9 Wildlife……………………………………………………………….... 54
Exhibit D-9.1 (Wyoming Game and Fish Letter) ………………………... 54.1
Exhibit D-9.2 (US Fish & Wildlife Service Website information) ……... 54.2
Exhibit D-9.3 (BLM Mountain Plover Protection Protocol)……………… 54.3

Wildlife Map ……………..…………………… …………………………. 55.1
Wildlife Supplemental Information…………………………………….. 55a
D-10 Wetlands…………………………………….……………………… . 56
Spill Management Plan ……………………………….………………………. 56
Noxious Weed Management Plan For Federal Lands …………………………… 56
Mine Plan…………………………………….…………………...……………… 58
Figure MP-1 Material Flow Diagram …...…………………..…………………… 58.1
Figure MP-2 Cast Back Mining System Schematic ………………………. 58.2
Figure MP-3 Typical Gentle Slope Highwall Reduction Schematic ……… 59.1
Supplemental Mine Plan Information……………………………………….. 60a
Figure MP-4 Typical Haul Road Construction Schematic ………………... 61.1
Mine Plan Maps 1 & 2 ………………………………………………………. ……..61.2
Interim Management Plan ……………………………………………………… 61
Monitoring Plan ………………………………………………………………….. 61
Typical Mining Equipment Used ………………………………………………... 62
Figure MP-5 Typical Pit Diversion Ditch Schematics……………………... 62.1
Reclamation Plan ………………………………………………………….……. 63
Drill Hole Plugging …………………………………………………………….. 64
Feasibility of Pit Backfill ……………………………………………………… 64
Isolation and Control of Acid-Forming, Toxic, or Deleterious Material ……….... 64
Post Closure Management ……………………………………………………….. 64
Revegetation Techniques and Seed Mixtures …………………………………….. 65
Quality Assurances ……………………………………………………………… 66
Bond Calculations ……………………………………………………………..... 67

SURFACE OWNER CONSENT

FEDERAL DOMAIN LANDS

Federal public domain lands included in this proposal are managed by the Worland Field Office of the Bureau of Land Management (BLM). These lands are covered by placer mining claims which, under federal law of the General Mining Act of 1872, give the applicant, Wyo-Ben, Inc., the right of access to extract the minerals claimed and to use the surface of the claim area in as careful and prudent manner as may be necessary to facilitate this extraction. The approval of this Plan of Operations (POO) by the BLM, under the terms of 43 CFR 3809, and the Cooperative Agreement between the Bureau and the State of Wyoming, Department of Environmental Quality - Land Quality Division (DEQ-LQD), will constitute surface owner consent on those lands.

Table 1: Proposed pit disturbance acreage by unpatented mining claim and ¼ ¼ legal description

Unpatented Claim Name	BLM Serial#	Division (1/4 1/4, lot or tract)	Section	Township / Range	# Acres by Legal Description	Actual Disturbance Acres Proposed in Claim or ¼ ¼
Wind 1	173913	E2SE4, NW4SE4, N2SW4SE4	19	43-95	140	72.7
Wind 2	173914	NE4SW4, N2SE4SW4, SW4SE4SW4, S2 Lot 9, NE4 Lot 9, Lot 10	19	43-95	134.7	122.7
Wind 3	173915	SW4SE4, SE4SW4, S2SW4SW4, N2SE4SE4	24	43-96	120	52.9
Wind 4	173916	NE4NW4, NW4NE4, S2NE4NE4, N2S2NE4	25	43-96	140	40.8
Wind 23	194117	SW4SW4, S2SE4SW4, S2NW4SW4	20	43-95	80	56.7
Wind 27	311176	N2NE4NE4	30	43-95	20	1.5
Wind 52	311177	N2NW4NW4	29	43-95	20	8.9
New Claim					19.3	19.3

TOTAL **375.5 ACRES**

APPENDIX A

I. **Surface ownership within the proposed Amendment Areas (locations illustrated on Appendices A, B, C, and E Map).**

Public Lands
C/O Bureau of Land Management
Worland Field Office
101 South 23rd Street
Worland, WY 82401

II. **Mineral ownership within the proposed Amendment Areas (locations illustrated on Appendices A, B, C and E Map).**

Public Lands
C/O Bureau of Land Management
Worland Field Office
101 South 23rd Street
Worland, WY 82401

APPENDIX B

Surface ownership within ½ mile of the proposed Amendment Areas (locations illustrated on Appendices A, B, C and E Map).

CANYON CONCRETE SAND & GRAVEL LTD
702 EAGLE RIDGE RD
PO BOX 1249
THERMOPOLIS, WY 82443

CLOUSE RICHARD BUCK & LEANN M
743 MISSOURI FLAT RD
THERMOPOLIS, WY 82443

FALGOUST LOUIS A JR & MARY A
659 HWY 120 W
THERMOPOLIS, WY 82443

LUTHER WAYNE D

S 3008 AULTS RD
REEDSBURG, WI 53959

HAMMOND LEO R & NINA L
661 HWY 120 W
THERMOPOLIS, WY 82443

HEINZE RANCH LIMITED PARTNERSHIP
840 MISSOURI FLAT RD
THERMOPOLIS, WY 82443

PUBLIC LANDS
C/O BUREAU OF LAND MANAGEMENT
101 SOUTH 23RD STREET
WORLAND, WY 82410

SHUMWAY EDITH & BEVERLY ANN
801 MISSOURI FLAT RD
THERMOPOLIS, WY 82443

WEISBECK PETER G & ANITA G
511 HWY 120 W
THERMOPOLIS, WY 82443

McCUMBER COLTER B & LINDA M
663 MISSOURI FLAT RD
THERMOPOLIS, WY 82443

MOORE THOMAS J & JO ANN
661 HWY 120 W
THERMOPOLIS, WY 82443

SHUMWAY BEVERLY ANN
801 MISSOURI FLAT RD
THERMOPOLIS, WY 82443

WEBBER TRUST
C/O WEBBER LANDIS F & BARBARA CO TRUSTEES
PO BOX 9
THERMOPOLIS, WY 82443

LAMOREAUX DELBERT & SHIRLEY MAE
730 MISSOURI FLAT RD
THERMOPOLIS, WY 82443

ALEXANDER LYMAN EUGENE &
MOREHEAD SUZANNE C/O WELCH MARY DELL
701 CEDAR VALLEY RD
GOLDENDALE, WA 98620

RODEN JOHN B JR & ELLEN
550 HWY 120 W
PO BOX 724
THERMOPOLIS, WY 82443

MCCUMBER DONALD D & ARLEA L
650 HWY 120 W
THERMOPOLIS, WY 82443

II. Other valid legal estates of record.

TCT WEST Inc./ Tri County Telephone Inc.
P.O. Box 671
Basin, WY 82410

Wyo-Ben, Inc.
P.O. Box 80687
Billings, MT 59108

U.S Department of Interior
101 South 23rd Street
Worland, WY 82410

State of Wyoming
200 West 24th Street
Cheyenne, WY 82001

Hot Springs REA/High Plains Power
P.O. 713
Riverton, WY 82501

Wyoming State Highway Commission
5300 Bishop BLVD
Cheyenne, WY 82009

Kevin & Elizabeth Mahoney

455 J Lazy M Road
Thermopolis, WY 82443

Donald McCumber
650 HWY 120 West
Thermopolis, WY 82443

Hot Springs County Commissioner
415 Arapahoe
Thermopolis, WY 82443

John B. Roden, Jr.
PO Box 724
Thermopolis, WY 82443

Form C-1

APPENDIX "C"

This appendix "C" represents the location of lands by legal subdivision, section, township, range, county, and municipal corporation, if any, (W.S. §35-11-406,(a),(vi)) and the number of acres in each description. No mining activity may take place on land for which there is not in effect a valid mining permit (W.S. §35-11-405). To include additional lands within a permit area it is necessary to amend the permit (W.S. §35-11-406,(a)(xii)), so care should be taken to include all lands necessary to the mining and reclamation operation as defined in W.S. §35-11-103,(e),(viii). All acreage figures should be obtained from official survey documents or recent surveys if available. An original U.S.G.S. topographic map with the permit area clearly outlined should accompany each permit application.

Lots 9 & 10, E ½ SWSW, SE ¼, Section 19, T43N, R95W	314 Acres
SW ¼ Section 20, T43N, R95W,	160 Acres
NWNW Section 29 T43N, R95W,	40 Acres
Lot 1, NENW, N ½ NE Section 30, T43N, R95W,	157 Acres

COUNTY of Big Horn   Description Acres__671.0__

Municipal Corporation NONE   Permit (amendment) Acres_671.0_____

______________________ __________ ______________________________

Reviewed (compiled), DEQ/LQD   Date   Applicant Signature   Date

______________________________ ______________   Permit No. 321C—Amend.

Checked, DEQ, LQD   Date

Revised 4/1980   Page 1 of 1   TFN_______________

APPENDIX E

The Appendix E Map Illustrate:

- Proposed areas of disturbance
  roads, railroads, public and private right-of-ways and easements, utility lines, etc. within or adjacent to the proposed disturbance areas
- Drainage areas
  previously affected areas adjacent to the proposed pit areas including haul roads servicing existing pits
- Existing 321C Permit Boundary

APPENDIX D

D-1. LAND USE

Historically, these lands have been used for livestock grazing, wildlife habitat, recreational hunting, and bentonite mining. Present land uses remain the same.

D-2. BRIEF HISTORY OF THE AREA

Thermopolis, Wyoming is a small town at elevation 4,500 feet above sea level and a population of 3,200 people. Thermopolis is renowned for its large Mineral Hot Spring and beautiful surroundings.

The Thermopolis area and surroundings is nestled among the foothills of the Owl Creek Mountains and resting on the west bank of the Big Horn River. Originally, Thermopolis was part of the Wind River Indian Reservation. The Shoshone and Arapahoe tribes sold this land to the United States, so the healing waters, known as of the Big Horn Hot Springs would be available to all people, known as "Gift of the Waters". Largely a tourism based economy, oil and gas, mining, farming, ranching, recreation and health care help supplement the economy of Thermopolis. Hot Springs County enjoys a low sales and property tax, which makes it a desirable place to live and do business.

The town of Thermopolis is the county seat of Hot Springs County. The town offers one county library, three banks, a weekly newspaper, three radio stations, full service hospital and rehabilitation center, Big Horn Basin Children's Center, and an active Senior Citizen Center, senior housing, and a nursing home. Brick and stone buildings, lawns and shrubbery, and landscaped parks give the town a well-groomed air. It is a trading center for this stock-raising area and for several oil fields. Locals claim 300 days of sunshine yearly for Thermopolis. The annual Labor Day rodeo, originally called Night Herd, attracts local and professional riders.

Settlement was begun in the 1870's near the mouth of Owl Creek, a few miles from the present site of Thermopolis. Outlaws from the Hole-in-the-Wall often harassed the community. In 1894, on election day, 50 rowdies rode in from the east and took possession of the place. They were dislodged by citizens toward evening, after a gun battle. When land near the hot springs was opened for settlement in 1897, the present town was founded. Dr. Julius A. Schuelke selected the name, a combination of thermae, Latin for hot baths or springs, and polis, Greek for city. When Hot Springs County was created in 1911, Thermopolis became its seat.

Geologically speaking, Thermopolis hot springs are a result of an anticline, or fold in the earth's surface, which allows rain water and snow melt to easily seep into deep cracks, heating it as it goes deep into the earth, and then resurfacing as the mineral pools. About 18.6 million gallons of 135 degree Fahrenheit water pass through the springs every day. Some geologists believe the underground formation that supplies the heated water to Thermopolis' Hot Springs is the same that provides heated water to Yellowstone National Park.

Thermopolis, Wyoming is approximately 150 miles from the East Gate of Yellowstone National Park. The central location provides easy access to major airports such as Cody, Billings, Casper, and Denver. The town also offers the service of a local airport and interstate bus line.

Legend Rock Petroglyph Site is a popular stop only about 30 miles away from the town of Thermopolis. The petroglyphs found in the sandstone in this area are close to 2,000 years old, and well preserved fossils can also be found in that same sandstone formation. Nearby are the Owl Creek Mountains, where one can view the towering Washakie Needles and a magnificent 75 foot waterfall. South of the Town is the Wind River Canyon where one can experience a visual geological tour along cliff walls that have been cut away by the churning whitewater of the Wind River.

D-3. ARCHAEOLOGY AND PALEONTOLOGY

This submission will constitute notification to the BLM's Worland Resource Area office regarding the proposed disturbance. No surface disturbance will occur until cultural resource clearance has been received from the Bureau, nor will surface disturbances continue if cultural resources are discovered during operations until additional clearance has been issued by the Bureau as stated in their stipulated approval.

Mettler and Associates of Cody, Wyoming performed a Class III cultural survey of the proposed disturbance area in the fall of 2012. The report has subsequently been submitted to the Worland, Wyoming Field Office of BLM for review.

D-4.CLIMATOLOGY

Although no site-specific climatic information is available for this Area, the following information was obtained for the Thermopolis, Wyoming area, approximately 5 miles southeast of the proposed disturbance area. Average annual precipitation is 11.61 inches; and the average annual temperature is 46.7 degrees Fahrenheit (Table D-5.1). The climate of the area is typical of cold desert regions of the intermountain west. Over fifty percent of the yearly precipitation occurs from April through July. The annual average snowfall for this area is 35.3 inches. Early freezes in the fall and late in the spring are characteristic. This results in long winters and short growing seasons. The average growing season (freeze-free period) for the principal agricultural areas is approximately 125 days according to the Western Regional Climate Center website at http://www.wrcc.dri.edu/

No wind speed or direction information is available for this specific area. However, the average wind speed at the Worland Airport ASOS (KWRL), 33 miles north of Thermopolis, recorded the average wind speed at 5.7 mph from 1996 – 2006 according to the website for automated stations (ASOS) at http://www.wrcc.dri.edu/htmlfiles/westwind.final.html.

Table D - 5.1 – Average Monthly Climatic Information Precipitation Normal's 1899 to 2009 Thermopolis, Wyoming				
	Average Maximum Temperature Fahrenheit	Average Minimum Temperature Fahrenheit	Average Ave. Temp. Temperature Fahrenheit	Average Total Precipitation Inches
January	35.1	6.2	20.7	0.37
February	41.0	12.3	26.7	0.41
March	50.5	21.3	35.9	0.79
April	61.4	31.5	46.5	1.71
May	71.6	40.5	56.1	2.19
June	81.9	48.0	65.0	1.48
July	91.1	54.1	72.6	0.85
August	89.5	52.2	70.9	0.59
September	78.3	42.1	60.2	1.17
October	64.5	31.1	47.8	1.08
November	48.5	19.2	33.9	0.57
December	37.4	9.7	23.6	0.39
Annual Ave.	62.6	30.7	46.7	11.61

D-5. TOPOGRAPHY, GEOLOGY, AND OVERBURDEN

Mr. Rick Magstadt (Geologist, Wyo-Ben, Inc.) has prepared the following general geologic description of the Big Horn Basin, supplemented with a "stylized" geologic column of the major Big Horn Basin Bentonite formations, which highlights the beds commonly mined in the Big Horn Basin (Fig. D-5.1, page 14.1). Overburden associated with the bed proposed for mining in this submission was sampled by Wyo-Ben, Inc. drillers using a medium duty four wheel drive truck equipped with a mounted auger drill. Samples were collected at five-foot increments to the contact with the top of the bentonite. Sample results from Intermountain Laboratories in Sheridan, Wyoming are reported in Tables D-5.1 through D-5.3a. Overburden sample locations are illustrated on the Soil Map in Appendix D-7.

Wyo-Ben uses a tiered overburden castback mining method that replaces material in roughly the same order as it was removed during the mining process. This castback system of moving overburden material will be employed unless conditions dictate otherwise. Based on overburden analysis of samples from the proposed mine area, no special handling of material is proposed, and overburden will be replaced in the tiered castback method during the backfill stage of all phases.

Regional Geology

The Big Horn Basin is an area bounded by Laramide mountain building to the northwest, north, and east, along with Absoraka volcanics to the west. The center of the basin is filled with flat-lying Eocene sediments, with progressively more complex folding and faulting in Mesozoic and Paleozoic strata as the flanks of the mountains are approached.

Economically important bentonite is limited to middle-lower Cretaceous, identified as the Frontier, Mowry, and Thermopolis Formations. The mining activity proposed with this application will eventually affect one bentonite bed of the Frontier formation of the southern Big Horn Basin, which has been successfully mined by Wyo-Ben, Inc. in the past.

Local Topography

Topography of the area planned for disturbance in the Pit 108T Extension Amendment/Update is mostly gently sloping to the north and north east, and moderately dissected by somewhat deep ephemeral drainages (see Topography map page 14.2) .

TABLE D-5.1. OVERBURDEN LABORATORY ANALYSIS—Frontier 3 Bed (Pit 108T Ext.) DS# 514-152P250

Depth (Feet)	pH	Sat. (%)	EC@25°C mmhos/cm	Ca meq/L	Mg meq/L	Na meq/L	SAR	ABP	Sand	Silt	Clay	Texture
0-6	7.8	73	6.23	20.7	7.20	62.1	16.6	30.0	37.5	28.8	33.8	Clay loam
6-11	8.3	120	2.66	1.44	1.15	22.9	20.1	24.2	30.0	36.3	33.8	Clay loam
11-14	8.4	121	1.96	1.16	0.86	16.1	16.0	27.0	35.0	32.5	32.5	Clay loam

*TABLE D-5.1a. Evaluation of Overburden Suitability— Frontier 3 Bed (Pit 108T Ext.) DS# 514-152P250**

Depth (Feet)	pH	Sat. (%)	EC@25°C mmhos/cm	SAR	ABP	Texture	Overall rating	Restrictive Features
0-6	S	S	S	U	S	S	U	Sodic
6-11	S	M	S	U	S	S	U	Sodic
11-14	S	M	S	U	S	S	U	Sodic

*Based on Criteria listed in Table I-2 of Guideline No. 1, Wyoming DEQ/LQD Topsoil and Overburden

TABLE D-5.2. OVERBURDEN LABORATORY ANALYSIS— Frontier 3 Bed (Pit 108T Ext.) DS# 512-65 m250

Depth (Feet)	pH	Sat. (%)	EC@25°C mmhos/cm	Ca meq/L	Mg meq/L	Na meq/L	SAR	ABP	Sand	Silt	Clay	Texture
0-6	7.8	32.6	0.58	2.63	0.89	2.96	2.23	6.95	50.0	26.3	23.8	Sandy clay loam
6-11	4.7	42.7	2.65	5.17	3.79	19.1	9.02	1.75	37.5	32.5	30.0	Clay loam
11-16	4.4	65.7	4.69	17.7	11.6	30.0	7.84	5.34	35.0	28.8	36.3	Clay loam
16-21	5.0	50.6	3.89	16.3	8.08	23.5	6.72	8.98	47.5	28.8	23.8	Loam

*TABLE D-5.2a. Evaluation of Overburden Suitability— Frontier 3 Bed (Pit 108T Ext.) DS# 512-65 m 250**

Depth (Feet)	pH	Sat. (%)	EC@25°C mmhos/cm	SAR	ABP	Texture	Overall rating	Restrictive Features
0-6	S	S	S	S	S	S	S	None
6-11	U	S	S	S	S	S	U	Acidic
11-16	U	S	S	S	S	S	U	Acidic
16-21	M	S	S	S	S	S	S	None

*Based on Criteria listed in Table I-2 of Guideline No. 1, Wyoming DEQ/LQD Topsoil and Overburden

TABLE D-5.3. OVERBURDEN LABORATORY ANALYSIS— Frontier 3 Bed (Pit 108T Ext.) DS# 414-147P900

Depth (Feet)	pH	Sat. (%)	EC@25°C mmhos/cm	Ca meq/L	Mg meq/L	Na meq/L	SAR	ABP	Sand	Silt	Clay	Texture
0-6	8.3	55.3	3.34	3.44	3.13	28.1	15.0	74.4	30.0	43.8	26.3	loam
6-11	8.1	58.8	5.21	23.1	14.2	39.8	9.21	71.2	20.0	48.8	31.3	Clay loam
11-6	7.5	43.2	3.43	20.8	9.68	25.6	6.55	17.4	32.5	37.5	30.0	Clay loam
16-21	6.9	84.7	1.60	4.87	1.84	12.6	6.90	15.6	20.0	35.0	45.0	Clay
21-27.5	7.1	75.0	1.57	5.23	1.73	11.2	6.02	17.2	47.5	25.0	27.5	Sandy clay loam

*TABLE D-5.3a. Evaluation of Overburden Suitability— Frontier 3 Bed (Pit 108T Ext.) DS# 414-147P900**

Depth (Feet)	pH	Sat. (%)	EC@25°C mmhos/cm	SAR	ABP	Texture	Overall rating	Restrictive Features
0-6	M	S	S	M	S	S	S	None
6-11	M	S	S	S	S	S	S	None
11-16	S	S	S	S	S	S	S	None
16-21	S	M	S	S	S	S	S	None
21-27.5	S	S	S	S	S	S	S	None

*Based on Criteria listed in Table I-2 of Guideline No. 1, Wyoming DEQ/LQD Topsoil and Overburden

D-6. HYDROLOGY

The premine surface topography associated with the drainages to be affected by these proposed activities is illustrated on the Hydrology Map. No perennial or intermittent streams will be affected by this proposed disturbance. Temporary diversions will comply with Wyoming DEQ Noncoal rules, chapter 3, section 2(e)(ii)(F) to allow passage of peak runoff from a 2 year, 6 hour precipitation event in a nonerosive manner. Permanent diversions (including reconstructed channels and adjacent topography) will comply with Noncoal rules, chapter 3, section 2(e)(iv), to be erosionally stable during the passage of the peak runoff from a 100 year, 6 hour precipitation event. If necessary, sediment control fabric fences or certified weed-free straw bales will be installed at discharge points into natural channels. These structures will be moved periodically to accommodate active mining areas.

In addition to the above commitments and practices, Wyo-Ben will apply the following operator-committed hydrology practices suggested by Brian Wood of WDEQ/LQD District II in the year 2010:

Postmine Slope Restoration

Unless otherwise approved by the DEQ/LQD, slopes will be reconstructed to have a concave to complex profile with a gradient similar to that which existed premine, and be designed to blend with adjacent native and previously reclaimed areas. Wyo-Ben strives to keep slopes within angles where they can be safely ripped along the contour with a farm tractor. Draws will be reconstructed within these slopes, consistent in size and position to existing native features both above and below the reclamation. These draws are critical for the management of down slope drainage and for the aesthetic transition between disturbed lands and the adjacent native landscape.

Postmine Drainage Reconstruction

Postmine drainage systems will be constructed such that drainages will be replaced at a density similar to or greater than what existed on the pre-mine landscape. During the construction of any reclaimed drainage, coarse rock will be imbedded in the backfill (if coarse rock is available) of the reconstructed channel. Energy dissipating elements such as the placement of straw bales, waddles, or rock armoring will be used at transition zones between native and reclaimed channels, zones where there is an unavoidable steep break in gradient, and any other place where accelerated erosion is likely to occur.

Many of the premine drainages within the Update area are well incised with a fairly narrow bottom width and steep side slopes. During reconstruction of a drainage, Wyo-Ben’s ability to replicate the original channel profile is limited by the equipment available for this purpose. Channel reconstruction is typically accomplished with scrapers and dozers, which results in an average channel bottom width of 12 feet. The reclaimed slopes that tie into the undisturbed, native channel bank will not exceed a slope of 3(H):1(V). Reclaimed slopes that tie into undisturbed, native channel banks will not exceed a slope of 3(H):1(V). It is assumed that a pilot channel will eventually develop, within the reclaimed channel bed that is anticipated to be similar to the typical native condition of two to five feet in width and approximately one foot in depth. The exact morphology of the pilot channel that develops will be a function of the bankful event's (generally assumed to be a flow event with an approximate return period of two years) characteristics.

Reclaimed channels will have a slope and sinuosity that approximates the premine condition. On occasion, Wyo-Ben will meander a reclaimed drainage to a greater degree than what occurred premine. This practice is intended to decrease velocity of runoff, and allow a greater amount of water to remain on reclaimed sites. To promote long term stability, Wyo-Ben will create a channel transition zone a minimum of 50 feet in length to allow the reclaimed channel to gradually taper into the native channel. Headcut development potential will be minimized by ensuring that the reclaimed channel slope through the transition zone will be that of the connecting native channel. Where possible, the transition zone will be set to occur on bedrock outcrop. If this is not possible, Wyo-Ben may elect to construct a buried riprap grade control structure. If a headcut were to begin to develop and was intercepted by this structure, the release of rock would prevent any upstream migration. In all cases the reclaimed channels will be designed and constructed to be stable for an event with a return period between two and five years and have sufficient capacity to carry the flow associated with the 100-year, 6-hour event.

All hydrologic calculations were developed by Greg Sweetser using Carlson Software's SurvCADD 2004, Hydrology Module; Carlson Software, 102 West Second Street, Maysville, KY. Rainfall is based on SCS Type 11 Distribution. Latitude 44-27-30 Longitude 107 – 52-30. Precipitation reported in tenths of an inch.

Precipitation Event Data

2 Year 6 Hour = 0.7 Event used for temporary diversions.
10 Year 6 Hour =1.2 Event used for corrugated metal pipe (CMP) Road Crossings.
25 Year 6 Hour = 1.4
50 Year 6 Hour = 1.6
100 Year 6 Hour = 1.8 Event used for stability of permanent diversions TABLE D-6.**1.**

HYDROLOGIC SUMMARIES Table D-6.1

SCS CN Number ---------88;				Hydrologic Soils Group--- C				
Information Point								
Basin Area (acres)	Relief ft.	Water course Length	2 Year, 6 Hour Volume (ac-ft)	Q (cfs)	10 Year, 6 Hour Volume (ac-ft)	Q (cfs)	100 Year, 6 Hour Volume (ac-ft)	Q (cfs)
A 496	425	11,061	2.6	2.49	30.32	32.07	35.03	37.35
B 221	368	5,743	1.16	1.18	13.51	16.08	15.61	18.73
C 35	170	2,499	0.18	0.26	2.14	4.38	2.17	5.13
D 65	290	3,265	0.34	0.46	3.97	7.72	4.59	9.04
E 1,410	690	18,472	7.41	7.09	86.2	91.15	99.59	1349.06
F 247	550	8,441	1.29	1.24	15.1	15.97	17.45	18.6
G 347	530	8,781	1.82	1.74	21.21	22.43	24.51	26.13
H 170	290	5,491	0.89	0.88	10.39	11.79	12	13.74
I 82	310	3,888	0.43	0.53	5.01	8.23	5.79	9.62
J 50	130	2,621	0.26	0.35	3.06	5.68	2.44	6.64

Haul and Material Movement Road Culverts

Only two small haul roads are proposed with this submission, those being HR 26.1 and HR 26.2. Proposed haul road HR 26.1 will cross the relatively large drainage labeled as E. A drainage crossing will be established through the lower portions of drainages E in order to remove material out on haul roads 26.1. There is already an established two track road that traverse this drainages as it is wide and only moderately deep. Wyo-Ben is proposing to improve that crossing by constructing a low water crossing through the lower portion of drainage E. Proposed haul road 26.2 does not cross any drainages, and no culverts are proposed for this road. A material movement road is proposed further up drainage E to move mining material from phase 39 to the open hole of phase 38 during the castback mining process. Again, this road will be a low water crossing as the drainage characteristics lends itself to that type of crossing.

ADJUDICATED WATER RIGHTS

Information regarding adjudicated surface water rights within one half mile from the proposed Amendment areas was obtained from the Wyoming State Engineer's website (http://seoweb.wyo.gov/e-Permit/Common/Home.aspx). Some stock ponds are located adjacent to the Amendment area. (See Ground and Surface Water report page 20.1 and Ground/ Surface Water Map, page 20.2). Wyo-Ben's mining activity will not affect any of those ponds. One stock pond (record number P13625OS) was recorded as being in the planned mining area in the west portion of the proposed mine plan. It is believed this pond was recorded in error, and the correct location is to the west and occurs outside the planned mine area in the SW SW section 24 T43N R96W.

Information obtained from the State Engineer's Office online database indicated several permitted water wells and springs within three miles of the Amendment area (See Ground/Surface Water Map, page 20.2). Two springs permitted by the BLM are recorded within the planned mine area of proposed pit 108T Ext in SE SE section 19 T43N, R95W and SW SW section 20 T43N, R95W. Upon further research by BLM personnel, it was determined that the spring recorded in section 20 is actually located in section 29 and will not be impacted by proposed mining. Additionally, BLM personnel are not certain the spring permitted in section 19 is active. After discussion with BLM personnel, it was decided that before any disturbance occurs in the area of the permitted spring in section 19, Wyo-Ben personnel will perform a site specific reconnaissance tour to determine if the spring is actually active. If it is determined that the spring is not active due to the lack of a visible seep or running water, Wyo-Ben will mine the area in question. If it is determined the spring is active, Wyo-Ben will consult with BLM to determine an appropriate disturbance-free buffer from the spring. Other water wells are recorded to the north, east and west, some in close proximity to the planned mine disturbance. Those wells are associated with residences adjacent to county road 25 (Missouri Flats road) and State highway 120, and are recorded as domestic use. Other wells in the area are recorded as being used for livestock watering. It is not anticipated that mining will encounter any permitted developed wells during mining activities associated with this proposal. Additionally, those permitted wells outside of planned mining should not experience pollution due to mining as the bentonite pits are relatively shallow, and no acidic or toxic forming substances are present in the overburden that will be mined. Additionally, no ground water was encountered during developmental drilling of potential pits of this Amendment/Update. Thus, Wyo-Ben, Inc. mining activities should not affect any permitted water wells. No other surface or ground water impacts are expected.

No water rights information was available on the state engineer's website for the Wind River Indian Reservation, a portion of which lies to the west within the three-mile boundary of the planned mine area.

D-7. SOILS

INTRODUCTION

A soil resource inventory for the Pit 108T Extension Amendment area was conducted by Matthew Call and Joe Sylvester of Wyo-Ben, Inc. in the fall of 2012. An Order II soil survey was conducted on areas proposed to be affected by mining activities and corresponds to the proximity of the bentonite beds. A more general level Order III survey was conducted on adjacent areas planned for haul roads, and areas that are less likely to be disturbed by mining but are in close proximity to bentonite beds. The total area inventoried consisted of approximately 483 acres. The soil map shows soil map units and recommended soil salvage depths for each unit. Also in this report are descriptions of soil pedons and soil map units, laboratory results of 39 soil pedons, and an assessment of topsoil suitability for each map unit.

Objectives

The objectives of the soil inventory are to provide mining and reclamation specialists and regulators with essential soil data, namely topsoil data, for project and reclamation planning. The specific tasks for the soil resource inventory were to:

- Identify and delineate soil map units.
- Define the physical and chemical characteristics of the soils.
- Develop soil map units.
- Determine suitability depth of topsoil for each soil that will be affected by mining activities.

STUDY AREA

Wyo-Ben's Pit 108T ext. Amendment/Update area is located in Hot Springs County, Wyoming, The study area is located 4 to 6 miles to the west of the town of Thermopolis Wyoming off of highway 120 (Meeteetse Highway) The site is characterized as having semi arid shrub and subshrub communities with the mean annual precipitation between 10 and 13 inches. The elevation of the site ranges from about 4,600 feet to about 5,000 feet.

The landscape is dominated by moderately gentle slopes to short steep slopes in the drainages that dissect the site. The site is vegetated mostly with big sagebrush communities, but there are also areas of saline/sodic soils soils that support birdfoot sagebrush, gardner saltbush, and rabbitbrush communities.

METHODS

Compilation of Available Information

The soil inventory was a refinement of the ongoing, preliminary mapping by the Natural Resource Conservation Service (NRCS). A review of the NRCS mapping of the area resulted in few soil series that were actually encountered in the project area. Therefore most of the soils were mapped, to the extent possible based on laboratory tests performed, to the family level.

Field Methods

Field work was conducted in accordance with the standards of the National Cooperative Soil Surveys (USDA, 1981 and 1983) at a scale of 1 inch = 400 feet. Field mapping was carried out using a backhoe where accessible.

Typical pedons of the soils occurring within the proposed affected area were described and sampled by soil horizons at a sampling rate according to Wyoming Department of Environmental Quality's "Guideline 1 for Topsoil and Overburden" (WDEQ, 1994). A total of 49 soil pedons were described and three observations were made and their locations are shown on the soil maps. Thirty-nine of these pedons were sampled and analyzed for topsoil suitability parameters.

Soil horizons were identified according to criteria in *Soil Taxonomy* (Soil Survey Staff, 1975, 1999) and described according to U.S. Department of Agriculture standards (USDA, 1981). Pedons were described on a modified NRCS pedon description form (Obtained from Mr. Buscher). Features documented for each horizon include: depth, color, mottles, texture, structure, reaction to hydrogen chloride, boundary, roots, clay films, coarse fragments, and consistence. In addition to horizon characteristics, site features were also documented and include, parent material, physiography, slope, aspect, relief, drainage, and rock outcrop.

Laboratory Analysis

Soil samples were submitted for analysis to Inter-Mountain Laboratories, Inc. in Sheridan, Wyoming. The analytical parameters and analytical methods employed are in Table D-7.1. The methods utilized include American Society of Agronomy (ASA) and USDA methods. Laboratory results are presented in Appendix D-7.2.

TABLE D-7.1 PARAMETERS AND METHODS OF SOIL ANALYSES

Parameter	Method
pH, Saturated Paste	Method 9-3.1.2, ASA Monograph Number 9, Part 2
Electrical Conductivity (EC)	Method 9-3.1.2 ASA Monograph Number 9, Part 2
Saturation Percent	Method 10.2.3, ASA Monograph Number 9, Part 2
Calcium	Method 10-2.3.1, ASA Monograph Number 9, Part 2
Magnesium	Method 10-2.3.1, ASA Monograph Number 9, Part 2
Sodium	Method 10.3.3, ASA Monograph Number 9, Part 2
Sodium Adsorption Ratio (SAR)	Method 2, 3a, USDA Handbook 60
Texture	Method 43-5, ASA Monograph Number 9, Part 1

Black, C.A. 1965. Methods of Soil Analysis, Part 1. American Society of Agronomy, Monograph No. 9; Second Edition; American Society of Agronomy.
Richards, L.A. ed. 1954. Diagnosis and Improvement of Saline and Alkaline Soils. U.S. Salinity Laboratory Staff. USDA Agricultural Handbook No. 60.
Page, A.L. 1982. Methods of Soil Analysis, Part 2. American Society of Agronomy Monograph No. 9; Second Edition; American Society of Agronomy.

SOILS

The soils of the study area have formed in residuum, alluvium, and slopewash of shale and sandstone. They are generally well to moderately well drained. Most of the soils contain a suite of neutral salts, such as the sulfates, carbonates, and chlorides of sodium and calcium. In addition, some have a considerable amount of exchangeable sodium, and with the salts they are classified as saline-sodic soils.

Alluvial soils are generally deep (greater than 40 inches) and have coarse to loamy textures. Soils derived from sedimentary rocks have a clay texture and are generally very shallow (less than 10 inches) and shallow (less than 20 inches). The soils in each map unit are classified below followed by descriptions of the soil map units.

Soil Classification

Soils were classified to the family level using *Keys to Soil Taxonomy* (Soil Survey Staff, 2010). TableD-7.2 lists the soils by their classification at the family level.

TABLE D-7.2 CLASSIFICATION OF THE SOILS

Description of the Soils and Soil Map Units

This section provides a description of the soils and map units occurring within the survey area. Descriptions of the typical soil pedons for each soil map unit are included with soil map unit narratives. Pedon descriptions and observations that are not included in the soil map unit descriptions are presented in Appendix D-7.1. All soil colors presented in the soil descriptions are of moist soil.

Nine soil map units were delineated within the survey area and are based on four general soil groups (Typic Ustic Haplocambids, Sodic Ustic Haplocambids, Lithic Ustic Torriorthents, and Lithic Ustic Haplocambids) and slope. Soil map units are listed in Table D-7.3.

The last number of the map units denotes the thickness of usable topsoil according to the following scheme:

0 = 0 inches of useable soil[1]
1 = 4 inches of useable soil- map unit
2 = 10 inches of useable soil- map unit
3= 15 inches of useable soil- map unit
4 = 20 inches of useable soil-map unit

[1] Includes both top and subsoil.

5= 40 inches of useable soil
6= 50 inches of useable soil

Slope ranges for the map units are designated by letters from A to D, A being the gentlest slope and D the steepest. The assigned letter for each map unit represents the steepest slopes in that unit but may include slopes shallower than the letter represents.

Slope (%)	Class
0-5	A
6-15	B
16-25	C
26-40	D

TABLE D-7.3 SOIL MAP UNITS

Soil Map Unit Code	**Soil Map Unit Name**
Very Shallow Soils Derived From Residuum	
40C-1	Loamy Lithic Ustic Torriorthents 1 to 25 percent slopes
41C-1	Clayey Lithic Ustic Torriorthents 1 to 25 percent slopes
Shallow Soils Derived from Residuum and Slopewash	
20B-2	Clayey Sodic Ustic Haplocambids, 1 to 15 percent slopes
22C-3	Loamy Lithic Ustic Haplocambids, 3 to 25 percent slopes
21C-4	Fine Typic Ustic Haplocambids, 3 to 25 percent slopes
Deep Soils Derived from Alluvium	
20B-4	Loamy Sodic Ustic Haplocambids, 1 to 15 percent slopes
21B-5	Loamy Typic Ustic Haplocambids, 1 to 15 percent slopes
23A-6	Loamy Ustic Haplargids, 1 to 5 percent slopes
Miscellaneous Map Units	
51D-0	Barren Shale lands, 5 to 40 percent slopes

- Map Unit 20B-2– clayey, smectitic, mesic, Sodic Ustic Haplocambids , 1 to 15 percent slopes

This map unit occurs in areas where the bentonite bed is near the surface, thus resulting in a saline/sodic soil. The unit is limited in the proposed disturbance area.

These soils are shallow, sodic affected in the B horizons, and occur on gentle to moderately steep slopes ranging from 1 to 15 percent. These soils are salt and sodic affected at or very near the surface, resulting in a shallow salvage depth recommendation. Supported vegetation is dominated by birdfoot sagebrush (*Artemisia pedatifida*) and sparse perennial grasses. Typically within the survey area, these soils have a clay surface layer about 3 inches thick. The subsoil (B horizon) is also mostly clay textured with minor gypsum and an average of 15 inches thick. The substratum (C horizons) is mostly clay to silty clay textured.

Soils of this map unit are derived from residual sodic shale and slopewash and are well drained. Permeability is slow to moderate and runoff is slow to moderate.

This map unit is in the clayey, smectitic, mesic, Sodic Ustic Haplocambids family. Four soil pedons were described in this map unit, and pedon 31 is described below. Description of pedon 31: clayey, smectitic, mesic, Sodic Ustic Haplocambids

A 0 to 3 inches; dark grayish brown (2.5 Y 4/2), clay loam; weak fine granular structure; loose, moderately sticky and moderately plastic; many fine roots; non effervescent clear smooth boundary.

Bw 3 to 14 inches; yellowish brown (10YR 5/4) clay; strong, coarse subangular blocky structure; very hard, moderately sticky and very plastic; some disseminated gypsum; common fine and medium roots; slightly effervescent; clear wavy boundary.

Cy 14-25 inches; olive brown (2.5Y 4/4) clay; massive; moderately sticky, plastic hard; 15 % gypsum crystals; no roots; noneffervescent.

C 25+ Bentonite

- Map Unit 20B-4– Loamy, mixed, mesic, Sodic Ustic Haplocambids , 1 to 15 percent slopes

This map unit occurs on alluvial areas with slopes ranging from 3 to 15 percent. It is of limited extent and occurs as small areas of the survey area. The vegetation is made up of a mixed desert shrub community.

This map unit is a consociation of soils, which are deep, well drained soils that formed in alluvium. Permeability of these soils is moderately fast and runoff is slow to medium. Four soil pedons were described in this map unit (pedons 5, 18, 28 and 39), and samples from pedons 18 and 28 were analyzed for topsoil parameters.

Typically within the survey area these soils have a surface layer that is loam 2 to 5 inches thick. The subsoil (B horizons) is loam ranging from 10 to 24 inches thick and commonly contains minor lime and gypsum accumulations. The substratum (C horizons) is loam with minor lime accumulations.

A representative profile of the Loamy mixed, mesic Sodic Ustic Haplocambid soils is pedon 28. This soil was described adjacent to a drainage.

Description of pedon 28: Loamy, mixed, mesic Sodic Ustic Haplocambids

A 0 to 3 inches; dark yellowish brown (10YR 4/4), loam; weak fine granular structure; loose, moderately sticky and slightly plastic; many fine and medium roots; stongly effervescent clear smooth boundary.

Bw 3 to 13 inches; brown (7.5YR 5/2) loam; moderate, coarse subangular blocky structure; hard,sticky and plastic; few fine roots; strongly effervescent; clear smooth boundary.

Bk 13-27 inches; brown (7.5YR 5/4) loam; strong coarse subangular blocky; moderately sticky, moderately plastic very hard; 5 % lime as filaments; few, fine roots; strongly effervescent.

C 27-40 inches; brown (7.5YR 5/4) loam, massive; hard, sticky and plastic; no roots; slightly effervescent

- Map Unit 21C-4—Fine Typic Ustic Haplocambids, 3 to 25 percent slopes

This map unit occurs on benches and backslopes that have collected eolian material, with slopes ranging from 3 to 25 percent. It is of limited extent and occurs in one area in the middle eastern portion of the survey area. Vegetation is made up of a Wyoming big sagebrush.

This map unit is a consociation of Typic Ustic Haplocambid soils, which are deep, well drained soils that formed in eolian and slopewash parent material. Permeability of these soils is moderately slow to slow and runoff is medium to fast. Four soil pedons were described in this map unit (pedons 4, 9, 12 and 50), and samples from pedon 4 and 50 were analyzed for topsoil parameters.

Typically within the survey area these soils have a surface layer that is loam to clay loam 2 to 4 inches thick. The subsoil (B horizons) is loam to clay loam textured, about 13 to 17 inches thick and commonly contains minor lime and gypsum accumulations. The substratum (C horizons) is clay to clay loam textured with approximately 10 to 15 % lime and gypsum accumulations and channers of shale and sandstone.

A representative profile of the Fine Typic Ustic Haplocambid soils is pedon 9. This soil was described on a low bench.

A 0 to 3 inches; very dark grayish brown (2.5Y 3/2) sandy loam; weak fine granular structure; loose, slightly sticky and slightly plastic; common fine and medium roots; non effervescent; abrupt wavy boundary.

Bw 3 to 11 inches; olive brown (2.5Y 4/4) clay loam; weak, medium subangular blocky structure; hard, sticky and plastic; few fine and medium roots; non effervescent; 20% channers; gradual smooth boundary.

C 11 to 26 inches; dark grayish brown (2.5Y 4/2) clay; massive; hard, sticky and plastic; no roots; strongly effervescent, 30% channers ; violently effervescent; gradual wavy boundary.

R 26+ inches Fractured sandstone

- Map Unit 21B-5—Coarse-Loamy Typic Ustic Haplocambids, 3 to 10 percent slopes

This map unit occurs on an alluvial lowland with slopes ranging from 3 to 10 percent. It is of limited extent and occurs in one area in the middle eastern portion of the survey area. Vegetation is made up of a Wyoming big sagebrush community.

This map unit is a consociation of Typic Ustic Haplocambid soils, which are deep, well drained soils that formed in alluvium. Permeability of these soils is moderately rapid and runoff is slow to medium. Three soil pedons were described in this map unit (pedons 36, 37and 38), and samples from pedon 36 and 37 were analyzed for topsoil parameters.

Typically within the survey area these soils have a surface layer that is sandy loam or loam 2 to 4 inches thick. The subsoil (B horizons) is sandy loam to loam textured, about 13 to 17 inches thick and commonly contains minor lime accumulations. The substratum (C horizons) is loam sandy clay loam textured with approximately 10 to 15 % lime and gypsum accumulations and channers of shale and sandstone.

A representative profile of the Coarse-Loamy Typic Ustic Haplocambid soils is pedon 37. This soil was described in an alluvial lowland. It is a member of the Coarse-Loamy, mixed, mesic Typic Ustic Haplocambids family.

A 0 to 3 inches; very dark grayish brown (2.5Y 3/2) sandy loam; weak fine granular structure; loose, non sticky and non plastic; many fine and medium roots; non effervescent; abrupt wavy boundary.

Bw 3 to 15 inches; dark grayish brown (2.5Y 4/2) sandy loam; strong, coarse prismatic structure; very hard, slightly sticky and moderately plastic; common fine and medium roots; non effervescent; gradual wavy boundary.

Bk 15 to 21 inches; pale brown (10YR 6/3) sandy clay loam; weak, coarse subangular blocky; very hard, slightly sticky and moderately plastic; very few fine roots; 5% lime as masses, violently effervescent; gradual wavy boundary.

C2 21 to 40 inches; light brownish gray (10YR 6/2) sandy clay loam; massive; very hard, slightly sticky and slightly plastic; 20% lime as masses; violently effervescent; very few, fine roots

- Map Unit 22C-3 Fine-Loamy Lithic Ustic Haplargids, 3 to 25 percent slopes

This map unit occurs on uplands and terraces with slopes ranging from 3 to 15 percent. It is of moderate extent and occurs throughout the project area. The vegetation is made up of a Wyoming big sagebrush community.

This map unit is a complex of Fine-Loamy mixed, mesic, lithic Ustic Haplargid soils with minor inclusions of clayey lithic ustic torriorthent and fine, typic ustic haplocambids. These soils are shallow and well drained, and formed in resisduum and slopewash. Permeability of these soils is moderately slow to slow and runoff is slow to medium. Seven soil pedons were described in this map unit and samples from pedon 5, 20, 23, 26, 51 and 52 were analyzed for topsoil parameters.

Typically within the survey area these soils have a surface layer that is clay or clay loam 2 to 4 inches thick. The subsoil (B horizons) is clay to silty clay loam about 6 inches thick channers of shale and sandstone. The substratum (C horizon) is clay loam with minor lime and gypsum accumulations and channers of shale and sandstone.

A representative profile of the Fine-Loamy Lithic Ustic Haplargid is pedon 20.

A 0 to 2 inches; olive brown (2.5Y 4/4) sandy clay loam; weak fine granular structure; loose, non sticky and non plastic; many fine and medium roots; non effervescent; clear smooth boundary.

Bt 2 to 8 inches; dark grayish brown (2.5Y 4/2) clay loam; moderate, medium Subangular blocky structure; hard, sticky and plastic; many fine and medium roots; common clay films; non effervescent; gradual wavy boundary.

R 8 to 24 inches; olive brown (2.5Y 4/4) clay loam; 70% medium sandstone channers. violently effervescent

- Map Unit 23A-6 -Loamy Ustic Haplargids, 0 to 5 percent slopes

This map unit occurs on gentle plains with slopes ranging from 0 to 5 percent. It is of moderate extent and occurs throughout the project area. This map unit is slated to be extensively mined in the project area. The vegetation is made up of a Wyoming big sagebrush community.

This map unit is a consociation of Loamy mixed, mesic, Ustic Haplargid soils. These soils are deep and well drained, and formed in alluvium. Permeability of these soils is moderately fast and runoff is slow. Five soil pedons were described in this map unit and samples from pedon 40, 41 and 49 were analyzed for topsoil parameters.

Typically within the survey area these soils have a surface layer that is sandy loam 2 to 4 inches thick. The subsoil (B horizons) is loam to sandy clay loam with accumulations of lime, and avereage about 15 to 20 inches thick The substratum (C horizons) is sandy clay loam with lime accumulations.

A representative profile of the Fine-Loamy Lithic Ustic Haplargid is pedon 41.

A 0 to 2 inches; brown (2.5Y 4/3) sandy loam; weak fine granular structure; loose, non sticky and non plastic; common fine and medium roots; non effervescent; abrupt smooth boundary.

Bt 2 to 8 inches; brown (10YR 4/3) sandy clay loam; moderate, strong subangular blocky structure; hard, sticky and moderately plastic; common fine and medium roots; common clay films; non effervescent; gradual wavy boundary.

BK 8-17 inches; brown (10YR 5/3) clay loam; moderate, coarse subangular blocky structure; hard, moderately sticky and plastic; 10% lime as masses; few fine roots; violently effervescent; clear wavy boundary

Ck 17 to 33 inches; brown (10YR 5/3) clay loam; massive; hard, sticky and plastic; 20% lime as masses; very few fine roots; violently effervescent; gradual wavy boundary.

C 33 to 47 inches; brown (10YR 5/3) sandy loam; massive; hard, sticky and moderately plastic; no roots; slightly effervescent.

- Map Unit 40B-1-Coarse- Loamy mixed mesic Lithic UsticTorriorthents, 3 to 15 percent slopes

This map unit occurs on plains with slopes ranging from 3 to 15 percent. It is of moderate extent and occurs throughout the project area, but will be affected by mining activity minimally. The vegetation is made up of a Wyoming big sagebrush community.

This map unit is a consociation of Coarse-Loamy mixed, mesic lithic Ustic Torriorthent soils. These soils are shallow, well drained that formed in resisduum of sandstone bedrock and slopewash. Permeability of these soils is moderately fast and runoff is slow. Four soil pedons were described in this map unit and samples from pedon 6 and 45 were analyzed for topsoil parameters.

Typically within the survey area these soils have a surface layer that is sandy loam 2 to 4 inches thick. Below the A horizon is sandstone bedrock.

A representive profine of the Coarse-Loamy, mixed mesic Lithic Ustic Torriorthent soil is pedon 6.

A 0 to 3 inches; dark brown (10YR 3/3) sandy loam; weak medium subangular blocky structure; loose, non sticky and non plastic; 5% small rock channers; many fine roots; noneffervescent; abrupt smooth boundary.

R 3+ inches; 90% fractured sandstone.

- Map Unit 41C-1—clayey, smectitic, mesic Lithic Ustic Torriorthents, 3 to 25 percent slopes

This map unit occurs on terraces and backslopes associated with bentonite beds with slopes ranging from 3 to 25 percent. It is of moderate extent and occurs throughout the project area, and will be affected extensively by mining activity. The vegetation is made up of a mixed shrub community.

This map unit is a consociation of clayey smectitic, mesic lithic Ustic Torriorthent soils. These soils are shallow, well drained that formed in resisduum of shalestone bedrock and slopewash. Permeability is moderately fast and runoff is slow. Seven soil pedons were described in this map unit and six samples were analyzed for topsoil parameters.

Typically within the survey area these soils have a surface layer that is sandy loam 4 inches thick. Below the A horizon is fractured shalestone bedrock.

A representive profine of the clayey, smectitic, mesic Lithic Ustic Torriorthent soil is pedon 3. Seven soil pedons were described in the fine-loamy, mixed, mesic Lithic Torriorthents map unit, and number 3 is described below.

A 0 to 4 inches; dark grayish brown (2.5Y 4/2) clay; weak fine granular structure;
loose, slightly sticky and very plastic; 40% small channers; may fine roots; slightly effervescent

R 90% fractured shalestone rock.

- Map Unit 51D-0: Barren Shale Lands, 1 to 40 percent slopes

This miscellaneous map unit is composed of barren shale lands with slopes from 1 to 40 percent. The shale is sodic and commonly contains gypsum. This unit is devoid of vegetation and has no suitable topsoil.

<u>Topsoil Suitability</u>

Topsoil suitability was determined for soils within the affected areas and suitability was based on criteria established by the Wyoming Department of Environmental Quality (WYDEQ, 1994). These criteria are shown in Table D-7.4. Sample analysis did not include boron and selenium. Suitable topsoil depths and volumes for each map unit within the affected area are shown in Table D-7.5.

Table D-7.4 Criteria to Establish Suitability of Topsoil			
Parameter	**Suitable**	**Marginal**	**Unsuitable**
pH	5.5-8.5	5.0-5.5	<5.0
EC (conductivity) mmhos/cm	0-8	8-12	>12
Saturation Percent	25-80	<25, >80	
Texture		Clay, silty clay, sand	
SAR (Sodium Adsorption Ratio)	0-10	10-12• 10-15	>15
Coarse Fragments (% vol.)	<25	25-35	>35

- for fine textured soils (clay > 40%)

Table D-7.5 Topsoil Summary				
Map Unit	**Composition of Map Unit (%)**	**Depth of Topsoil (inches)**	**Salvage Depth of Topsoil/ Subsoil (inches)**	***Limitations***
20B-2-Sodic Ustic Haplocambids 20B-4- Sodic Ustic Haplocambids	100 100	24 40	6/4 6/14	SAR > 15 often at surface, but EC is generally not high until below 6 inches. SAR and EC high only deeper in the profile
21B-5 Typic Ustic Haplocambids 21C-4 Typic Ustic Haplocambids	100 100	40 30	6/34 6/14	None None
22C-3 Lithic Ustic Haplargids	85	15	6/9	Bedrock below 15 inches
23A-6 Loamy Ustic Haplargids	100	50	6/44	None
40B-1 – Lithic Ustic Torriorthents	100	4	4/0	Bedrock below 4 inches
41C-1—Lithic Ustic Torriorthents	100	4	4/0	Bedrock below 4 inches
51D-0 Miscellaneous	100	0	0/0	Does not support vegetation probably due to high SAR and EC

TABLE D-7.6 PROJECTED TOPSOIL AND SUBSOIL STOCKPILE VOLUMES AND AVERAGE SOIL REPLACEMENT DEPTHS.

PIT No.	Total Affected Acres	Stockpile Volume Topsoil B.C.Y.	Stockpile Volume Subsoil B.C.Y.	Average TS/SS Replacement Depth in Inches	Total TS/SS to be removed in cubic yards
108T ext	375.5	30,000 yd^3	50,000 yd^3	6"/ 11"	305,404 yd^3/ 559,907 yd^3

Topsoil and Subsoil Handling

Wyo-Ben will save all available soil for reclamation during the initial stripping part of mining. Soils will be saved by one of two methods. Soils will be stockpiled with topsoil and subsoil being stockpiled separately and signed to distinguish the two qualities. Alternatively, soils may be spread directly on a previously backfilled and contoured phase of mining, behind the current phase, when a new phase of mining is being opened (spreading soils live).

Many of the soils in the amendment/plan area contain a thin surface layer that is suitable as topsoil. A small quantity of subsoils, however, are generally unsuitable due to high exchangeable sodium (high SAR) and some have a high amount of salts that are more soluble than gypsum (high EC). Most of the unsuitable subsoils with a high SAR are saline-sodic which means that they contain appreciable quantities of neutral salts and enough sodium ions to seriously affect most crops. Based on chemical data alone, some of the recommended salvage depths listed above are greater than what WDEQ guideline 1 would suggest. However, due to the limited amount of soil resources in this area, subsoil will be saved separately from topsoil to allow a buffer between topsoil and the more chemically detrimental spoil material. This is shown in table D-7.5-topsoil summary.

Table D-7.6 shows an average 11-inch depth for subsoils in the areas planned for bentonite mining. This number is somewhat deceiving because at least half of the planned mine area actually has shallow soils in the pre mine condition, and thus would not have deep subsoils in reclamation, while those areas with deep subsoils (30 inches or more) would have deeper soils in reclamation. Wyo-Ben will attempt to spread some of those deeper soils to areas of shallower native soils when practical.

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United States Department of Agriculture (USDA). 1981/1993. Soil Survey Manual, Chapter 4, Examination and Description of Soils in the Field. Manuscript (430-V-SSM, May 1981).

Wyoming Department of Environmental Quality. November, 1984. Guideline No. 1, Topsoil and Overburden.

APPENDIX D-7.1

PEDON DESCRIPTIONS

Map Unit 20B-2 (Clayey Sodic Ustic Haplocambids), 1 to 15 percent slopes

Pedon 32: Sodic Haplocambid. This soil was described on a birdfoot dominated bench on a 3% grade.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-1	clay	2.5Y 5/2	1 f granular	5	none	eo
Bw	1-10	clay	2.5Y 5/4	2c abk	3	none	eo
C	10+	Bentonite Bed					

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Map Unit 20B-4 (Loamy Sodic Haplocambids), 1 to 15 percent slopes

Pedon 39:Loamy Sodic Ustic Haplocambid. This soil was described on a gentle 3% slope of the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-1	Sandy loam	10YR 4/4	1 f granular	<1	none	esl
Bw1	1-9	clay loam	10YR 5/4	2m sbk	<1	none	esl
Bw2	9-23	Clay loam	10YR 5/4	1 f sbk	<1	Minor lime	esl
C1	23-36	loam	10YR 5/3	massive	<1	Minor lime	esl
C2	36-42	clay	10YR 4/4	massive	<1		eo

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 18 Loamy Sodic Ustic Haplocambid. This soil was described on a 10 % slope of the Thermopolis shale formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-3	Clay loam	10YR 4/4	1 f granular	0	none	estr
Bk	3-12	loam	10YR 4/4	2m sbk	0	none	estr
Ck	12-22	Sandy loam	10YR 5/4	1f sbk	0	none	estr
C2	22-39	Clay loam	10YR 5/4	massive	0	none	estr
R	39+	Bed rock					

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 16: Loamy Sodic Ustic Haplocambid. This soil was described on a 3% slope of a bentonite outcrop of the Frontier formation

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-3	Sandy clay loam	2.5Y 4/4	1 f granular	3	none	estr
Bk	3-12	silty clay loam	2.5Y 4/4	3 c abk	5	none	estr
C1	12-26	clay	2.5Y 3/2	3 c pris	0	none	eo
C2	26-36	clay	Mostly	bentonite	0		eo

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 5: Loamy Sodic Ustic Haplocambid. This soil was described on a 2% slope with mixed shrub of the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-3	Clay	2.5Y 4/4	2 m sbk	0	none	eo
Bw	3-16	clay	2.5Y 4/4	2 vc pris	0	none	eo
Cr	16-32	Clay	2.5Y 3/2	mass	0	Minor gyp	eo

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Map Unit 21C-4 (Typic Ustic Haplocambids), 1 to 25 percent slopes

Pedon 4: Typic Ustic Haplocambid. This soil was described on a 20% backslope with Wyoming Big Sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-2	Silty clay	2.5Y 4/4	1 f granular	5	none	eo
Bw	2-8	Clay loam	10YR 5/3	3 c sbk	2	none	eo
C1	8-12	clay	2.5Y 3/2	1 m sbk	50	Minor gyp	eo
C2	13-30	bentonitic	material				

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 12: Typic Ustic Haplocambid. This soil was described on a 25% backslope with Wyoming big sagebrush and rabbitbrush on the Frontier formation..

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-4	Sandy clay	2.5Y 3/2	1 c sbk	0	none	eo
Bw1	4-10	clay	2.5Y 4/2	3 vc pris	0	none	eo
Bw2	10-20	clay	2.5Y 4/2	2 c sbk	0	none	eo
C	20-38	Clay loam	10YR 4/3	massive	0	Minor gyp	eo

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 50: Typic Ustic Haplocambids. This soil was described on a 25% slope with sparse Wyoming big sagebrush and grass of the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-2	Silty clay loam	2.5Y 4/4	1 f granular	0	none	estr
Bw	2-11	loam	2.5Y 4/4	3 c sbk	0	Minor lime	ev
C	11-32	Clay loam	2.5Y 4/4	massive	0	Minor lime	ev
R	32+						

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Map Unit 22C-3 (Lithic Ustic Haplargids), 1 to 15 percent slopes

Pedon 23: Lithic Ustic Haplargids. This soil was described on a 5 % slope with Wyoming big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-4	Silty loam	2.5Y 4/2	1f granular	3	none	eo
Bt	4-11	clay	2.5Y 4/4	2 c sbk	20	none	eo
Bk	11-18	clay loam	2.5Y 4/2	2m pris	20	lime	estr
Ck	18-31	Clay loam	2.5Y 4/4	massive	20	none	estr
R	31+	Bed rock					

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 26: Lithic Ustic Haplargids. This soil was described on a 5 % slope with Wyoming big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-1	Sandy loam	2.5Y 4/2	1 f granular	20	none	eo
R	1-5	Rock layer	N/A	rock	0	none	eo
Bt	5-9	clay	2.5Y 4/2	2 m pris	10	Minor lime	ev
Btk	9-14	Clay loam	2.5Y 6/2	1 m pris	5	Minor lime	ev
R	14-30	bedrock					

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 52: Lithic Ustic Haplargids. This soil was described on a 5 % slope with Wyoming big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-2	Sandy loam	2.5Y 4/2	1 f granular	0	none	eo
Bt	2-11	Clay loam	2.5Y 4/2	2 c pris	0	Minor lime	est
C	11-21	sandy clay loam	2.5Y 3/2	massive	0	Minor lime	est
R	21+	bedrock					

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 29: Lithic Ustic Haplargids. This soil was described on a 5 % slope with Wyoming big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-3	Sandy loam	2.5Y 4/2	1 f granular	0	none	eo
Bt	3-8	clay	2.5Y 4/4	2 m sbk	5	none	esl
C	8-20	Sandy Clay loam	2.5Y 5/4	massive	10	none	eo
R	20-31	bedrock					

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 15: Lithic Ustic Haplargids. This soil was described on a 3 % slope with Wyoming big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-2	Clay loam	2.5Y 4/2	1 f granular	0	none	eo
Bt	2-15	clay	2.5Y 4/2	3 c sbk	0	none	eo
R	15+	bedrock					

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 8: Lithic Ustic Haplargids. This soil was described on a 5 % slope with Wyoming big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-2	Clay loam	2.5Y 4/2	1 f granular	0	none	esl
Bt	2-12	Clay	2.5Y 4/2	3vc pris	0	none	esl
R	12+	bedrock	10YR 4/4	massive	0	Minor lime	esl

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Map Unit 21B-5 (Lithic Ustic Haplargids), 1 to 15 percent slopes Pedon 36: Coarse-Loamy Typic Ustic Haplocambid. This soil was described on a 10 % slope with big sagebrush the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-2	Sandy loam	10YR 3/4	1 f granular	0	none	eo
Bw	2-9	Sandy loam	10YR 3/3	2 vc abk	0	none	eo
Bk	9-15	loam	10YR 4/3	1 c pris	0	Minor lime	ev
Ck1	15-28	Clay loam	10YR 5/3	massive	0	Minor lime	ev
Ck2	28-41	Clay loam	10YR 4/4	massive	0	Minor lime	ev
R	41+	Sandstone	bedrock				ev

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Map Unit 23A-6 (Loamy Ustic Haplargids), 1 to 15 percent slopes

Pedon 43: Loamy Ustic Haplargids. This soil was described on a 2 % slope with big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-1	Silty loam	10YR 3/3	1 m sbk	0	none	eo
Bt	1-6	Clay loam	10YR 4/4	2 c pris	0	none	eo
Bk	6-17	loam	10YR 5/4	2 c pris	0	Minor lime	ev
Ck	17-25	Clay loam	10YR 5/4	massive	0	Minor lime	ev
Cy	25-36	clay	10YR 4/4	massive	0	Minor gyp	eo

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 49: Loamy Ustic Haplargids. This soil was described on a 2 % slope with big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-3	Sandy loam	2.5Y 3/2	1 f sbk	0	none	eest
Bt	3-12	Clay loam	10YR 4/3	2 c pris	5	none	eo
Bk	12-26	Clay loam	2.5Y 4/2	1 c sbk	20	Minor lime	est
C1	26-40	Clay loam	2.5Y 4/2	massive	0	none	est
C2	40-60	Sandy clay loam	2.5Y 4/2	massive	0	none	est

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent
Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Map Unit 40B-1 (Loamy Lithic UsticTorriorthents), 1 to 15 percent slopes

Pedon 11: Loamy lithic Ustic Torriorthent. This soil was described on a 5 % slope with big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-4	Sandy loam	10YR 3/3	1 f granular	5	none	eo
R	4+	Sandstone	Bedrock				

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent
Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 17: Loamy lithic Ustic Torriorthent. This soil was described on a 5 % slope with big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-2	Sandy loam	10YR 3/3	1 f granular	5	none	eo
R	2+	Sandstone	Bedrock				est

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent
Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 30: Loamy lithic Ustic Torriorthent. This soil was described on a 2 % slope with big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-1	Sandy loam	10YR 4/2	1 f granular	3	none	est
Cr	1-4	Sandy clay loam	10YR 3/3	1 m sbk		none	est
R	4+	Sandstone	Bedrock				ev

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent
Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Map Unit 41C-1 (Clayey Lithic Ustic Torriorthents), 1 to 25 percent slopes

Pedon 13: Clayey lithic Ustic Torriorthent. This soil was described on a 25 % slope with sparse big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-4	Clay loam	2,5Y 3/2	1 f granular	0	none	eo
R		Bedrock					

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent
Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 14: Clayey lithic Ustic Torriorthent. This soil was described on a 10 % slope with sparse big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-3	Clay loam	2,5Y 4/4	2 m sbk	2	none	eo
R	3+	Bedrock					

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent
Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

Pedon 21: Clayey lithic Ustic Torriorthent. This soil was described on a 25 % slope with sparse big sagebrush on the Frontier formation.

Horizon	Depth (in)	Texture	Color	Structure	Coarse Fragments (%)	Visible Salts	Reaction to 10% HCl
A	0-4	Clay loam	2,5Y 3/2	1 f granular	0	none	eo
R		Highly fractured	shalestone				

Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent
Structure: 1 = weak, 2 = moderate, 3 = strong; vf= very fine, f = fine, m = medium, c = coarse; abk = angular blocky, sbk = subangular blocky. Reaction to 10% HCl: eo = noneffervescent, evsl = very slightly effervescent, esl = slightly effervescent; estr = strongly effervescent, ev = violently effervescent

APPENDIX D-7.2

Representative Soil Pedon Photographs

APPENDIX D-7.3

SOIL LABORATORY RESULTS

D-8. Vegetation

METHODS

Joe Sylvester and Jared Welsh of Wyo-Ben, Inc. performed vegetation community mapping for this proposal in June of 2012. Map unit boundaries were identified and mapped in the field on scaled aerial photographs and then transferred into electronic format. Two vegetation map units were identified and described in the study area, and species lists for each unit were developed (Table D-8.2).

Numerical cover data were estimated using the point intercept line transect sample method applied as outlined in WDEQ/LQD Guideline 2, Vegetation. Each map unit was sampled using an extended reference area concept as described in Guideline 2. Line transects starting locations were randomly selected by Matt Call on aerial photographs. The aerials was then used in the field to locate actual transect starting points. Transect directions were randomly determined by spinning a ballpoint pen and extending the tape in the direction the pen indicated on the ground. Each transect was conducted by stretching a 50 meter tape in a straight line, then walking down the left side of the tape and dropping a sharpened rod at one meter intervals (50 observations per transect). Only the first hit of the rod was recorded. However, if the transect path encountered large barren outcrops, the path of a previously measured transect, the disturbance boundary, or another map unit, a new random direction was determined by spinning the pen. Separate cover values were calculated for vegetation, rock, litter, and bare ground for each transect using the following equation:

$$\% \text{ cover} = \frac{\text{total \# of parameters hit per transect}}{\text{50 (total possible hits per transect)}} * 100$$

Sample adequacy (or a maximum number of transects as described in Guideline 2) was achieved in each map unit of the proposed extended reference area as defined by the formula recommended in Guideline 2. Average vegetation cover values were calculated for each map unit. These data summaries are presented in Appendix D-8.1 and the vegetation field data sheets are presented in D-8.2.

Shrub density belt transects were also conducted by counting each shrub and subshrub rooted within one (1) meter of the right side of the 50 meter long tape on each transect. The data is summarized in Appendix D-8.1.

Representative vegetation map unit photographs are presented for each map unit (Appendix D-8.3). Photograph locations are illustrated on the vegetation map.

Site Description

Wyo-Ben's Pit 108T ext. Amendment/Update area is located in Hot Springs County, Wyoming, The study area is located 4 to 6 miles to the west of the town of Thermopolis Wyoming off of highway 120 (Meeteetse Highway). The site is characterized as having semi-arid shrub and subshrub communities with the mean annual precipitation between 10 and 13 inches. The elevation of the site ranges from about 4,600 feet to about 5,000 feet.

The landscape is dominated by moderately gentle slopes to short steep slopes in the drainages that dissect the site. The site is vegetated mostly with big sagebrush communities, but there are also areas of saline/sodic soils that support birdsfoot sagebrush, gardner saltbush, and rabbitbrush communities.

Proposed affected acreages for each vegetation map unit are summarized by pit in Table D-8.1.

Table D-8.1. Vegetation Map Units; Affected Acreages

MAP UNIT	Pit 108T EXT – Potential Disturbance
BSGR –Big Sage Grassland	252.6 ACRES
Mixed Shrub Complex (OC MSC)	122.9 ACRES
Totals	375.5 ACRES

MAP UNIT DESCRIPTIONS

BSGR – Big Sage – Grassland

This map unit generally occurs on shallow loamy soils and deeper alluvial deposits in lower drainages of the Frontier geologic formation associated with this proposal. Terrain is variable, ranging from 0 to 40 percent on mixed aspects. The dominate shrub of this map unit is Wyoming Big Sage (*Artemisia tridentate*). Common grasses include Sandberg Bluegrass (*Poa sandbergii*) and Bluebunch Wheatgrass (*Agropyron spicatum*). Additional understory species include prickly pear cactus (*Opuntia polyacantha*), Cheatgrass (*Bromus tectorum*), and Small tumblemustard (*Sisymbrium loeselii*). Photographs included in Appendix D-8.3 illustrate different aspects of this vegetation map unit.

OC - Mixed Shrub Complex (OC MSC)

This map unit occurs in the Frontier geologic formation associated with the proposed bentonite bed, and contains a variety of soils, topographic aspects and slopes. Vegetation dominance within this map unit is similar to the BSGR Map Unit but not at the same density of plant species. Additionally within this map unit are outcroppings of bentonite, usually along drainages, where vegetation is much more sparse and consist of other shrub species such as rubber rabbitbrush (*Chrysothamnus nauseosus*) and buckwheat (*Eriogonum brevicaule*). Dominate species of the unit include Wyoming Big Sagebrush and Sandberg Bluegrass. Other common understory species of this map unit consists of Snakeweed (*Gutierrezia sarathrae*), Cheatgrass, Bluebunch Wheatgrass , Spiny Phlox (*Phlox hoodia*) and Wild buckwheat (*Eriogonum brevicaule*).

Photographs of this map unit illustrate various visual aspects (Appendix D-8.3).

TABLE D-8.2 VEGETATION SPECIES LIST

Pit 108T EXT

Genus	species	Four Letter Designation	Common Name	BSGR	OC-MSC
Grasses					
Agropyron	spicatum	AGSP	Bluebunch Wheatgrass	X	X
Bouteloua	gracilis	BOGR	Blue Gramma	X	X
Bromus	tetcorum	BRTE	Cheatgrass	X	X
Carex	filifolia	CAFI	Threadleaf sedge	X	X
Elymus	elymoides	ELEL	Bottlebrush Squirreltail	X	
Koeleria	cristata	KOCR	Prairie Junegrass	X	X
Oryzopsis	hymenoides	ORHY	Indian ricegrass	X	X
Poa	sandbergii	POSA	Sandberg Bluegrass	X	X
Sporobolus	airoides	SPAI	Alkali Sacaton	X	X
Sporobolus	cryptandrus	SPCR	Sand Dropseed		X
Stipa	comata	STCO	Needle and Thread Grass	X	X
Oryzopsis	hymenoides	ORHY		X	X
Forbs					
Allium	textile	ALTE	Wild Onion	X	X
Arenaria	hookeri	ARHE	Hooker Sandwort	X	X
Comandra	umbellata	COUM	Bastard Toad-Flax	X	X
Cryptantha	celosioides	CRCE	Miner's Candle	X	X
Descuraimia	richardsonii	DERI	Tansy Mustard	X	X
Eriogonum	brevicaule	ERBR	Wild Buckwheat	X	X
Lappula	redowski	LARE	Western Stickseed	X	X
Leptodactylon	pungens	LEPU	Prickly Gillia		X
Machaerenthera	canescens	MACA	Hoary tansyaster	X	X
Malacothrix	torreyi	MATO	Desert Dandelion		X
Phlox	hoodi	PHHO	Spiny Phlox	X	X
Plantago	patagonica	PLPA	Wolly plantain		X
Platyschkuhria	integrifolia	PLIN	Platyschkuhria	X	X
Sisymbrium	loeselii	SILO	Small Tumblemustard	X	X
Sphaeralcea	coccinea	SPCO	Scarlet Globemallow	X	X
Sphaerophysa	salsula	SPSA	Swainson's Pea		X
Tragopogon	dubius	TRDU	Salsify		X
Vicia	americana	VIAM	American Vetch	X	X
Xylorhiza	glabriuscula	XYGL	Woodyaster		X
Succulent					
Opuntia	polycantha	OPPO	Prickly Pear	X	X
Shrubs					

Artemisia	tridentata	ARTR	Wyoming Big Sage	X	X
Atriplex	gardenerii	ATGA	Gardener's Saltbush		X
Chrysothamnus	nauseosus	CHNA	Rubber Rabbitbrush	X	X
Sarcobatus	vermiculatus	SAVE	Greasewood	X	X
Gutierrezia	sarothrae	GUSA	Broom Snakeweed	X	X
Atriplex	canescens	ATCA	4-Wing Saltbush		X
Artemisia	pedefia	ARPE	Birdsfoot	X	X
Trees					
Juniperus	osteosperma	JUOS	Utah Juniper		X

Key to vegetation map unit codes

1) BSGR – Big Sage Grassland
2) MSC - Mixed Shrub Complex

Appendix D-8.1

Vegetation Cover Summary Tables

VEGETATION SUMMARY TABLES

Pit 108T EXT

Line Transect Data

(BSGR) Big Sage Grassland Extended Reference Unit

STUDY AREA	% Veg Cover *	% Litter Cover	% Rock Cover	% Bare Ground	%Total Cover	Number of Samples (N)	Sample Adequacy (N Min) Veg Cover	Standard Deviation Veg Cover
	62.9	13.0	3.1	21.0	79.0	20	20	8.2

(OC – MSC) Mixed Shrub Complex Extended Reference Unit

STUDY AREA	% Veg Cover *	% Litter Cover	% Rock Cover	% Bare Ground	%Total Cover	Number of Samples (N)	Sample Adequacy (N Min) Veg Cover	Standard Deviation Veg Cover
	51.4	8.3	15.9	24.4	75.6	20	20	8.99

Percent Vegetation Cover by Species and Life Form for Pit 108T EXT

Big Sage – Grassland (BSGR) Extended Reference

Lifeform Species			
Perennial Grasses	**# of hits in transects**	**Percent Cover Relative**	**Percent Cover Total**

POSA	303	48.02	30.30
BRTE	40	6.34	4.00
BOGR	2	0.32	0.20
KOCR	2	0.32	0.20
STCO	4	0.63	0.40
AGSP	10	1.58	1.00
Total	**361**	**57.21**	**36.10**
Annual Forbs			
SILO	19	3.01	1.90
DERI	1	0.16	0.10
LARE	15	2.38	1.50
UNK	4	0.63	0.40
Total	**39**	**6.18**	**3.90**
Perennial Forbs			
COUM	1	0.16	0.10
PHHO	8	1.27	0.80
SPCO	1	0.16	0.10
VIAM	3	0.48	0.30
Total	**13**	**2.06**	**1.30**
Succulents			
Oppo	18	2.85	1.80
Total	**18**	**2.85**	**1.80**
Subshrubs			
Arpe	2	0.32	0.20
Gusa	2	0.32	0.20
Total	**4**	**0.63**	**0.40**
Shrubs			
Artr	189	29.95	18.90
Chna	5	0.79	0.50
Save	2	0.32	0.20
Total	**196**	**31.06**	**19.60**
Grand Total	**631**	**100.00**	**63.10**

OC - Mixed Shrub Complex (MSC) Extended Reference

Lifeform Species	# of hits in Transects	Percent Cover Relative	Percent Cover Total
Perennial Grasses			

POSA	218	42.83	21.80
AGSp	12	2.36	1.20
SPAI	9	1.77	0.90
STCO	1	0.20	0.10
BRTE	20	3.93	2.00
KOCR	2	0.39	0.20
Total	**262**	**51.47**	**26.20**
Annual Forbs			
DERI	1	0.20	0.10
SILO	10	1.96	1.00
LARE	8	1.57	0.80
UNK	1	0.20	0.10
Total	**20**	**3.93**	**2.00**
Perennial Forbs			
SPCO	6	1.18	0.60
PHHO	12	2.36	1.20
ERBR	12	2.36	1.20
LEPU	7	1.38	0.70
XYGL	3	0.59	0.30
PLIN	5	0.98	0.50
VIAM	8	1.57	0.80
COUM	2	0.39	0.20
SPSA	1	0.20	0.10
Total	**56**	**11.00**	**5.60**
Succulents			
OPPO	5	0.98	0.50
Total	**5**	**0.98**	**0.50**
Subshrub			
ARPE	8	1.57	0.80
Total	**8**	**1.57**	**0.80**
Shrubs			
ARTR	120	23.58	12.00
CHNA	11	2.16	1.10
ATGA	8	1.57	0.80
GUSA	19	3.73	1.90
Total	**158**	**31.04**	**15.80**
Grand Total	**509**	**100.00**	**50.9**

Belt Transect Data

Species	**Shrub Density for Big Sage Grassland Map Unit (BSGR) (# individuals/M^2)**
ARTR	1.003
CHNA	0.022
GUSA	0.046
SAVE	0.004
ARPE	0.146
Total Shrubs/M^2	**1.221**
Species	**Shrub Density for Mixed Shrub Complex (OC – MSC) (# individuals/M^2)**
ARTR	0.746
CHNA	0.067
SAVE	0.001
GUSA	0.244
ARPE	0.149
ATGA	0.006
Total Shrubs/M^2	**1.213**

Appendix D-8.2

Vegetation Field Data Sheets

(BSGR) Pages 1 – 10

(OC MSC) Pages 11 - 20

Appendix D-8.3

Vegetation Aspect Photographs

D-9. Wildlife

The area associated with this proposal was evaluated for potential significant or critical/important wildlife habitat during site visits by Matt Call and Joe Sylvester of Wyo-Ben, Inc.   Habitat and noted species information gathered during wildlife field visits were sent to the Wyoming Game and Fish Department (WG&F) for their review. Threatened or endangered species information concerning the proposed mine area was obtained from the Fish and Wildlife Service's (FWS) website. The FWS website indicated possible concern for impacts to the Colorado and Platte river systems and their associated threatened and endangered species, Migratory Bird Treaty Act species, bald and golden eagles , Greater sage grouse (*Centocercus urophasianus*), Ute ladies tresses (*Spiranthes diluvalis*), Whitebark pine (*Pinus albicaulis*), Canada lynx (*Lynx Canadensis*), and grizzly bear (*Ursus arctos horribilis*) (Exhibit D-9.2). The Wyoming Game and Fish (WG&F) response indicated concern for possible disturbance in the Thermopolis sage grouse core area in the SE corner of section 25 T43N R95W, and aquatic invasive species contamination by mine and water pump equipment (Exhibit D-9.1).

Species listed in the FWS list of species of concern that do not occur in the proposed Pit 108T Extension area due to lack of appropriate habitat include Ute ladies tresses, white bark pine, Canada lynx and grizzly bear. No further discussion of mitigation to protect habitat or individuals of those species will occur in this appendix. Further, upon researching the drainages of the Colorado and Platte river systems, it was determined that impacts to those waters will not occur due to possible sediments released by this proposed activity. However, sediment control measures will be implemented to protect immediate and surrounding drainages

A potential raptor nest and sightings of Golden Eagles was identified by Wyo-Ben personnel. The potential nest was observed in a sandstone cliff located in the NE¼NW¼, Section 36, T43N R96W, and the location (illustrated on Wildlife Habitat Map) is within 3/4 mile of proposed pit 108T Extension and in close proximity to other pits in the area including pit 101T. As a standard operating procedure of Wyo-Ben, Inc., when raptor nesting activity occurs within ½ mile of unobstructed sight distance, we will proceed as follows: (1) In areas where mining or hauling activity is ongoing prior to February and raptor activities such as nest prepping occurs within ½ mile unobstructed view, Wyo-Ben will continue mining operations and monitor the nest on a regular basis. At the sign of permanent residency of the nest, mine activity will cease, and DEQ and FWS will be notified to determine mitigation measures; (2) in areas where nesting occurs within ½ mile unobstructed sight distance prior to commencement of mining or hauling activity, Wyo-Ben will not initiate activity until consultation with the DEQ and FWS has allowed evaluation of site specific mitigation options.   As a general measure, If nesting activity of eagles occurs within ½ mile unobstructed sight distance of an active mining or hauling area (1/4 mile obstructed sight), Wyo-Ben, Inc. will mitigate impacts to that nest by avoiding activity from February 1 through August 15, or until it has been determined that the young have fledged and can survive independent of the nest.

Wyo-Ben has reviewed the approved Sage Grouse Core breeding areas (version 3) to verify that Pit 108T Extension is outside of the mapped "Sage Grouse core breeding area".

Although the proposed disturbance boundary is outside the Thermopolis core area boundary, the core area is in close proximity to portions of planned mining in section 30 T43N R95 W, but is quite far from the southeast corner of T43N R96W section 25 as was noted as a concern in Exhibit D-9.1. Wyo-Ben's protocol is to determine the permitted mine boundary with GPS and only conduct mining operations within that boundary. This protocol will ensure no disturbance occurs in the Thermopolis sage grouse core area.

The nearest sage grouse lek site is approximately 1.5 mile south of the proposed pit 108T Extension mine plan and grouse sign has been observed in the proposed disturbance area. In order to protect possible nesting or brooding sage grouse from harm, spring nest searches will be conducted ahead of planned mine phase disturbances during the time frame from April 1 to July 1. If sage grouse nests are found, mining activity that is within proximity to the nest will cease until chicks have fledged, and can survive independent of the nest. Additionally, to reduce impacts to sage grouse in general, Wyo-Ben will maintain concurrency of reclamation of mined areas, including the use of a diverse seed mix of native grasses, forbs and shrubs, including big sagebrush in appropriate environments. Wyo-Ben will voluntarily monitor Sage Grouse use of the Rattlesnake Gulch 3 Lek on an annual basis and report the occupancy to the Wyoming Game and Fish. Further, no surface disturbance will occur within 0.6 miles of the rattlesnake gulch 3 Lek from March 15 to June 30.

Migratory Bird Treaty Act (MBTA) bird species occur in the area of proposed mining. Wyo-Ben will implement measures to protect these birds as follows: Nest surveys will occur in areas planned for topsoil removal when either new phases of the pit are stripped, where C.O.P or T.O.P areas will be striped of topsoil, or during new road construction. These searches will be conducted starting April 15 and continue through July 15 whenever an activity occurs involving the removal of topsoil. If an active nest is discovered during the search, planned topsoil removal of that area will be halted until the chicks can survive independent of the nest. Wyo-Ben has three days from the time of the search to the time of topsoil is removed. If topsoil removal does not occur within that time frame, Wyo-Ben will conduct another nest search before topsoil will be stripped. As explained above, Wyo-Ben commits to remain current with reclamation as mining progresses. This practice will further mitigate impacts to MBTA birds by returning useable habitat in a timely manner. Although encounters with mountain plovers (Charadrius montanus) is not likely to occur based on habitat types present, Wyo-Ben will protect those birds, if encountered, as described in the BLM Mountain Plover Protection Protocol (Exhibit D-9.3)

The Wyoming Game and Fish Department also had concerns of aquatic invasive species (AIS) contamination of the perennial streams of the area. AIS contamination from mine and water pump equipment will not be a problem in this area because mine equipment never encounters waters from potentially contaminated streams, and haul road water is obtained from the town of Thermopolis water station.

No power lines will be constructed as part of this proposed activity. Postmine topography will be designed to maximize topographic diversity, enhancing both vegetation diversity and wildlife habitat.

If previously unidentified significant habitat or significant wildlife usage are observed during the course of conducting this proposed activity, Wyo-Ben, Inc. will notify the appropriate agency and implement recommended mitigation if significant impacts are observed.

Proposed Pit 108T Ext. Supplemental Wildlife Information

1) Observed and Potential Wildlife Species Within and Adjacent to Proposed Pit 108T Extension.

The Wyoming Game and Fish webpage https://wgfd.wyo.gov/web2011/Departments/Wildlife/pdfs/WILDLIFE_ANIMALATLAS0002711.pdf was referenced to determine potential wildlife species that could occur within or adjacent to proposed pit 108T Extension based on habitat types present. Those species listed with an asterisk have been observed during wildlife surveys and other environmental studies.

Birds

- American Kestrel (Falco sparverius)
- Barn Owl (Tyto alba)
- Black-billed Magpie (Pica hudsonia)
- Blue Bird (Sialia Mexicana)*
- Brewer's sparrow (Spizella breweri)*
- Burrowing Owl (Athene cunicularia)
- Chuckar (Alectoris chukar)
- Common Poorwill (Phalaenoptilus nuttall)
- Common Nighthawk (chordeiles minor)
- Common Raven (Corvus corax)
- Crow (Corvus brachyrhynchos)*
- Ferruginous Hawk (Buteo regalis)
- Golden Eagle (Aquila chrysaetos)*
- Greater Sage Grouse (Centrocercus urophasianus)*
- Green-Tailed Towhee (Pipilo chlorurus)
- Horned Lark (Eremophila alpestris)*
- Lark Bunting (Calamospiza melanocorys)
- Lark Sparrow (Chondestes grammacus)*
- Long-Billed Curlew (Numenius americanus)
- Meadowlark (Sturnella neglecta)*
- Merlin (Falco columbarius)
- Mourning Dove (Zenaida macroura)*
- Peregrine Falcon (Falco peregrinus)
- Pinyon Jay (Gymnorhinus cyanocephalus)
- Prairie Falcon (Falco mexicanus)
- Red Tailed Hawk (Buteo jamaicensis)
- Rock Wren (Salpinctes obsoletus)*
- Rough-Legged Hawk (Buteo lagopus)

- Sage Thrasher (Oreoscoptes montanus)
- Sage Sparrow (Artemisiospiza nevadensis)
- Say's Phoebe (Sayornis saya)
- Short-eared Owl (Asio flammeus)
- Swainson’s Hawk (Buteo swainsoni)
- Turkey Vulture (Cathartes aura)*
- Vesper sparrow (Pooecetes gramineus)*
- Western Kingbird (Tyrannus verticalis)
-

Mammals

- American Badger (axidea taxus)
- Coyote (Canis latrans)
- Deer Mouse (Peromyscus maniculatus)
- Desert Cottontail Rabbit (Sylvilagus audubonii)*
- Merriam's Shrew (Sorex merriam)
- Mule Deer (Odocoileus hemionus)*
- North American Porcupin (Erethizon dorsatum)
- Northern Grasshopper Mouse (nychomys leucogaster)
- Northern Pocket Gopher (Thomomys talpoides)
- Pallid Bat (Antrozous pallidus)
- Pronghorn antelope (Antilocapra Americana)*
- Prairie Vole (Microtus ochrogaster)
- Sagebrush Vole (emmiscus curtatus)
- Spotted Bat (Euderma maculate)
- Western Harvest Mouse (Reithrodontomys megalotis)
- Western Spotted Skunk (Spilogale gracilis)
- White-tailed Jack Rabbit (Lepus townsendii)*

Amphibians and Reptiles

- Bull Snake (Pituophis catenifer sayi)
- Great Basin Gophersnake (Pituophis catenifer deserticola)
- Greater Short Horned lizard (Phrynosoma hernandesi)*
- Least chipmunk (Tamias minimus)
- Plains Spadefoot (Spea bombifrons)
- Prairie Rattle Snake (Crotalus viridis)*
- Northern Sagebrush Lizard (Sceloporus graciosus graciosus)*
- Wandering Gartersnake (hamnophis elegans vagran)

2) Proposed Mitigation to Impacts to Observed Species.

Birds

a) Birds on the Migratory Bird Treaty Act list and their nests will be protected, as discussed on page 55, by conducting spring nest searches prior to any initial surface disturbing activity from April 15 to July 15 of each year. If nests are discovered, mine activity in the vicinity of the nest will be halted until the chicks can survive independent of the nest.

b) Additional Proposed Sage Grouse Mitigation:

To be in compliance with the Governor of Wyoming's Greater Sage Grouse Executive Order 2015-4, and the recently approved BLM Big Horn Basin Resource Management Plan, Wyo-Ben will commit to the following restrictions:

- No new surface disturbance or overburden removal will occur between March 15th to June 30th in areas within 2-miles of active leks.

- Support activities will be allowed within the 2-mile perimeter, restricted to:

Bentonite haulage, field drying of bentonite stockpiles, development drilling, environmental compliance activities (for example, stormwater management or dust abatement), wildlife monitoring, surveys, and similar low-impact scientific assessments. In no case shall more than one piece of equipment be running at any time.

c) Raptors: Golden eagle nest protection measures are discussed on page 54. Other raptor species nests will be protected in a similar manner.

Mammals

a) Highly Mobile Mammals: It is anticipated that those mammals that are highly mobile will not be in danger of destruction from heavy equipment. Temporary removal of habitat will occur. Wyo-Ben will practice concurrent reclamation, using targeted seed mixes to reduce impacts to those mammal species.

b) Low Mobility Mammals: Those mammals that have low mobility relative to being able to escape destruction by moving heavy equipment will regrettably most likely be destroyed when mining occurs in their immediate vicinity. No pre-mine searches for those species with mine restrictions due to presence are proposed. Wyo-Ben will practice concurrent reclamation so that those areas can be recolonized by other surrounding low mobility mammalian species when habitat conditions are returned as a result of reclamation.

c) Bats: Since bats are active in the evening and night time hours (nocturnal activity), impacts to those species due to mining is anticipated to be very low.

Amphibians and Reptiles

a) Amphibians: The only amphibian that may potentially be present in habitats that will be affected by mining is the Plains Spadefoot. If any are present in the planned mine area, they will most likely be destroyed by mining. No active or dormant plains spadefoot frogs were noted in the proposed mine area.

b) Reptiles: Observed reptiles in the area are rattle snakes, great horned lizards, and northern sagebrush lizards. It is anticipated that rattle snakes will be able to avoid destruction by heavy equipment. The two lizards observed may potentially be harmed by heavy equipment in mine areas. No pre mine surveys are proposed for these species, but concurrent reclamation will be conducted to return useable habitat for future reptiles in which to colonize.

D-10. Wetlands

The 108T Extension project area was surveyed for wetlands using criteria in the 1987 Corps of Engineers (COE) Field Guide for Wetland Delineation Manual prepared by the Wetland Training Institute, and other waters of the U.S.

Wetland surveys involve the analysis of three factors: Vegetation, Hydrology, and Soils. In the vegetation sections, percent cover by dominant plant species is provided as an ocular estimate. When total vegetative cover is greater than 100%, both over and understory species are considered. If criteria were met in all categories, wetland status was assigned. No jurisdictional wetlands were identified during site visits to the mine proposal area.

Spill Management Plan

Wyo-Ben Inc. will immediately notify both the Wyoming Water Quality Division of the Department of Environmental Quality and the Worland Field Office of the BLM for any accidental spills of petroleum or other industrial products involving more than twenty-five gallons. Soils contaminated by smaller spills will be removed to the Wyo-Ben Lucerne Mill Site for natural weathering treatment.

No solid wastes, either hazardous or non-hazardous, will be disposed of at these sites. All bulk fuel storage tanks will either be bermed for spill containment or placed in an excavated containment pit.

Wyo-Ben, Inc.'s Noxious Weed Management Plan for Federal Lands

Wyo-Ben Inc. will implement the following management plan to address noxious weed control on all of its activities conducted on Federal lands:

- All noxious weeds listed by the Hot Springs County Weed and Pest Department will be monitored for presence.
- All Wyo-Ben, Inc. activity areas and access routes will be inventoried for infestations of noxious weeds of particular concern. Wyo-Ben Inc. personnel will conduct on-going monitoring of noxious weed presence at all of our activity sites and their access routes and take action, in cooperation with the Hot Springs County Weed and Pest, to remove noxious weeds when located.
- All off-road access will be limited to only necessary routes to minimize impacted areas and reduce spread of weeds.
- Access will be controlled through infested areas until weed removal is accomplished.
- Wyo-Ben, Inc. will train mining personnel (including contractor representatives) to identify noxious weeds of particular concern to assist in the monitoring process. Weed identification materials will be made readily available to assist in field identification.
- Vegetation will be reestablished on all soil disturbed by construction, reconstruction or maintenance activities at the first available window of opportunity. This may mean waiting until the fall planting season to help ensure the success of vegetation establishment.

- All seed obtained from commercial sources will be laboratory tested for the presence of noxious weed seed. Native seed offered by local collectors will only be utilized after Wyo-Ben, Inc. personnel have consulted with the collectors to ensure they possess the skills necessary to recognize noxious weeds of concern and sign a statement certifying that they have not collected seed in areas with noxious weed infestations.
- All hay or straw used for check-dam construction or mulching will be certified weed-free.
- All herbicides used on the Bureau of Land Management (BLM)-administered public land will be approved by the BLM prior to its application by first obtaining a Pesticide Use Proposal.

MINE PLAN

The mining activity proposed with this submission consists of one proposed pit sequence on the Frontier 3 bentonite bed (108T Extension). Two separate areas will be mined in the proposed pit 108T extension, those being mine areas west of currently permitted 108T and east of pit 108T (see mine plan map). The west portion of pit 108T Extension will be mined first. The first phase overburden will be cast into the last phase open hole of currently permitted and active pit 108T. This will initiate the castback mining sequence of proposed pit 108T Extension. Although mining will begin on the west portion of the proposed pit 108T Extension, it is anticipated that phases on the east portion will also be opened not long after west area mining has begun. Mining is projected to begin as soon as the proposal is approved, or when the last phase of currently permitted pit 108T is mined (expected within a year). Table MP-1 includes a listing of projected legal descriptions and disturbance acreages for the proposed 108T Extension pit sequence.

TABLE MP-1. PROJECTED DISTURBANCE LOCATIONS AND ACREAGES

PROPOSED PITS	TWP. RGE. SECTION	PROPOSED DISTURBANCE ACREAGE
108T Extension (F3 Bed) Including stockpile areas And campsites	T43N, R95W Sections 19, 20, 29, 30 T 43N, R96W Sections 24 and 25	375.5 acres

This will be an open pit bentonite mine excavated using standard castback mining techniques and procedures. Castback mining is a technique that is beneficial both environmentally and economically on many levels. Figure MP-2 shows a model of the castback system as described:

1. In this process, overburden from the first open pit (phase 1) of a pit sequence is usually piled and contoured adjacent to the first open hole (sometimes referred to as an out-of-pit overburden pile). Top and subsoil are also stockpiled separately in the same general area. At the earliest opportunity, the original stockpiled overburden from Phase 1 is contoured to match existing native topography, after which at a later date, subsoil and topsoil is spread from existing soil piles in preparation for seeding. If soil stockpiles will be in place longer than one year, they will be seeded with a BLM approved perennial grass seed mix.
2. Once bentonite is removed from phase 1, topsoil and subsoil is stripped from phase 2 and placed on existing piles established from Phase 1; and the

remaining overburden (sometimes referred to as “spoil”) from the next open pit of the sequence (Phase 2) is cast into the open hole of phase 1.

3. Once bentonite is removed from Phase 2, topsoil from Phase 3 is removed and placed on existing soil piles from Phases 1 and 2. Subsoil from phase 3 is stripped and spread onto the backfilled and contoured portion of Phase 1(live spreading of soil) and the remaining overburden is cast into Phase 2.
4. After removal of bentonite from Phase 3, topsoil from Phase 4 is spread onto contoured and previously subsoiled Phase 1. The subsoil is then live spread onto Phase 2; and the remaining overburden from phase 4 is cast into Phase 3.
5. This process repeats itself until the end of the pit sequence. At this time, since there is not overburden available from another phase of mining, material to fill the last hole is acquired by reducing the highwall’s steep grade, also known as a highwall reduction (see figure MP-3). The castback/ highwall reduction process provides ecological and economic pragmatism by promoting live topsoil and subsoil distribution, as well as eliminating the need for long-distance transport of the original overburden from phase 1. In many cases this distance can exceed a mile. The cost, energy, and equipment necessary for that effort are well above accepted norms.

Environmentally, castback mining with a highwall reduction is beneficial on many levels. First, a pit sequence can take between five to ten years to complete. In this time, micro fauna residing in a deep stockpile effectively die before soils are spread. Also, soil degradation can occur due to soil compaction and compromised soil structure. These conditions degrade a soil’s ability to support desirable vegetation on reclaimed sites. Wyo-Ben prefers concurrent reclamation with the spreading of “live” soils to reestablish vegetation, resist erosion, and develop stable and productive habitats following disturbance. Furthermore, complete blocks of reclamation behind the final phases would be impossible because of the need for access corridors to accommodate the hauling of material. Finally, using the castback mining procedure greatly reduces the amount of disturbance when compared to older mining techniques where overburden was piled on the highwall and outcrop sides of the pit until commencement of backfilling.

The Mine Plan Map shows two highwall reduction sites, both on the last phases of mining in the two separate sections of proposed pit 108T Extension. Both highwall reductions will be done in areas of gentle slopes. Those delineated areas are considered to be the limit of necessary disturbance required to accomplish reclamation of the last phase in a pit sequence. In most cases, less area than that shown on the mine plan map is needed to accomplish final fill and contour of the last phase. Figures MP3 illustrate a typical Sequence (1 through 6) for the gentle-sloped highwall reduction.

A highwall reduction is accomplished by removing top and subsoil adjacent to the last phase, and dozing the underling material adjacent to the highwall into the open hole of the last phase. Once contouring of the last phase is complete, the area is then soiled using both material from the highwall reduction area, and a partial amount of saved soil from two or three previous phases.

The area of disturbance in the highwall reduction is determined by three factors. One is the depth of the highwall of the last phase. The second is the size of the phase;

and the last factor is swelling of overburden as it breaks up during mechanized removal from the previous phase. In general, a deep highwall will require more disturbance in the highwall reduction area. Similarly, larger pits will require a larger reduction disturbance. Finally, if the overburden in the next-to-last phase has a high swell factor, there will be more material to go into the last phase of mining because not all is needed to fill the hole of the next to last phase of mining. This opportunity, when present, minimizes the area of disturbance required for the highwall reduction. Wyo-Ben intentionally reduces the size of its phases as mining progresses through the pit sequences. When the last phase is reached, it is usually smaller than the first phases of mining, thus reducing the area needed for the highwall reduction.

Soil handling in castback mining is also more economically and environmentally sound than in older mine techniques. As mentioned above, stockpiling soil for long periods of time can be detrimental to the resource. Castback mining reduces or eliminates stockpiling time. Soon after the first phase of overburden is contoured in-place, it can be soiled with stockpiled top and subsoils obtained from the first few phases of mining. Further, as shown in figure MP-2, upon backfilling and contouring of the first and subsequent phases of mining, soils can be spread live as it is being removed from subsequent phases. This has two tremendous advantages. First, it reduces the degradation of soil structure and microbes, and increases vegetation establishment due to seed propagules contained in the soil. Second, it reduces the cost of soil redistribution by decreasing the amount of material handling. As well as salvaging top and subsoil, Wyo-Ben also salvages material below subsoil that is chemically and physically beneficial or neutral to vegetation establishment. This practice allows us to put a buffer between the more detrimental spoil material and the top and subsoil, thus increasing the chance of establishing a diversity of desirable vegetation.

Proposed pit layouts, all potential disturbance areas, temporary stockpile areas (T.O.P.), and contoured overburden piles (C.O.P.) are illustrated on the Mine Plan Map. Pit delineation boundaries show the limit of the resource that is economically viable to extract based on market demands. Often, due to various economic or physical conditions, we do not disturb to the limits shown in the proposal. This routinely results in less acreage disturbance than originally proposed. Also, the width of disturbance is based on the geologic dip of the bentonite bed of interest. Steeply dipping beds usually result in a narrower pit than flatter-lying beds. When practical, Wyo-Ben leaves mosaics of undisturbed lands within the proposed pit sequence or between adjacent pit sequences which enhance reclamation aesthetics, and serve as a seed source for reclaimed lands. Pit area locations, boundaries and stockpile sites will be staked prior to disturbance; and contractors will be monitored on a regular basis in order to maintain control of Wyo-Ben's high standards of mining and reclamation. The C.O.P. and T.O.P. areas that are identified on the Mine Plan Map may consist of the following items: topsoil stockpiles, subsoil stockpiles, temporary bentonite stockpiles, camp sites for mine equipment, and overburden material from initial or subsequent phases of mining.

Table MP-2 lists specific volumes, disturbance acreages and projected mining dates for each proposed pit. Wyo-Ben anticipates annual mining of 37.5 acres in the 108T Extension area.

TABLE MP-2. PROJECTED DISTURBANCE ACREAGE AND MINING DATES

PROPOSED PITS BEDS # OF PHASES	PROJECTED OPENING DATE	PROJECTED ENDING DATE	APPROXIMATE DISTURBANCE PER YEAR	AVERAGE OVERBURDEN PER PHASE	PROPOSED DISTURBANCE ACREAGE
			ACRES	CUBIC YARDS	
108T Ext. (F3 Bed)	**Year 2015**	**Year 2024**	**37.5**	**107,000**	**375.5**

Figure MP-1, Pit 108T Extension Material Flow Map illustrates general material movements, volumes, and final pit cut backfill strategies. Backfill of all other phases will be achieved during the castback sequences as illustrated in Figure MP-2. Topsoil (T.S.), subsoil (S.S.), contoured overburden stockpiles (C.O.P.) and temporary overburden piles (T.O.P.) locations are also illustrated on the Map.

Existing Haul Roads HR-26 and new haul roads HR-26.1 and 26.2 will provide access to the proposed pits. An additional material movement road will be constructed as illustrated on the Mine Plan and other Maps. Haul roads will be constructed according to BLM standards including a crown and drainage ditch, with strategically placed water exit ditches to prevent pooling on roads (See figure MP-4 page 61.1).

Interim Management Plan

In the event Wyo-Ben temporarily closes a pit, interim management procedures will be implemented as follows: A Berm will be placed in all areas around the pit phase where a highwall occurs. A berm will also be installed at the ramps of the pit to prevent entrance. Temporary water diversions will be made around the pit to prevent water from entering the particular pit phase. Bentonite stockpiles and stockpiles with potential deleterious material (spoil piles, etc.) will be bermed to prevent off-site sedimentation. Ephemeral drainages that have the potential to receive deleterious material will have check damns installed. If soil piles are expected to be in place for an extended period due to the temporary closure of the pit, they will be seeded to prevent erosion and loss of soil. All equipment and supplies will be kept within the disturbance area. Any fuel storage tanks will either have a perimeter berm or placed within an excavated containment pit to control any potential spills. Annual and semi-annual inspections will be completed by Wyo-Ben employees, a representative from the DEQ, and a representative from the BLM. Finally, the pit area will be monitored on a regular basis to determine if problems are occurring that need to be addressed.

Monitoring Plan

Wyo-Ben utilizes contractors to conduct the mining and reclamation operations of our operations. Our mining supervisor, Greg Sweetser, works with our contractor's field supervisors to ensure that mining is being conducted in a lawful and environmentally responsible manner. He also supervises and directs the reclamation of pits. Monitoring of field operations and contact with our contractor's field supervisors occurs on an almost daily basis. This ensures that mining and reclamation is being conducted according to Wyo-Ben's high standards of mine regulation compliance, reclamation and safety. Wyo-Ben will monitor its reclaimed lands as explained below in post closure management.

Wyo-Ben personnel will record the number and locations of pronghorn and mule deer noted when they are observed are in the Pit 108T Extension Amendment Area. Any known raptor nests in the Amendment area will be monitored for activity starting in February and continue to July 15th. MBHFI nest searches, including mountain plover, will be conducted prior to any initial surface disturbing activities during the dates April 15 to July 15.

PREVENTION OF OFF-SITE SEDIMENTATION

To prevent sediment run-off and loading of undisturbed lands and waters, Wyo-Ben will implement the following practices in our mine operations: Storm water will be diverted around disturbed areas. Diversion ditches will be constructed to divert water away from current mining activity. Those ditches will be constructed using a grader blade resulting in v-shaped ditches with 2:1 slopes. All ditches will be constructed to handle drainage from a 2-year, 6-hour storm event as required by WDEQ/LQD Non Coal Rules, Chapter 3, Section 2(e)(ii)(F).

In areas where hydrologic calculations suggest a larger diversion ditch is needed, or will be in place for a time period where sedimentation may become an issue, a scraper will be used to create the ditch to ensure adequate capacity. The scraper-constructed ditch will have a bottom width of approximately 12-feet with approximately 1:1 side slopes. All temporary diversion ditches will be reclaimed as mining progresses in the castback sequence.

Temporary overburden or soil stockpiles will not be placed in drainages. If surface water accumulates in an open pit, it will either be buried or used to control dust in the disturbed area or on haul roads.

Bentonite stockpiles will either be bermed or silt fabric fences will be installed to contain potential run-off of bentonite material.

Typical Mining Equipment

Typical equipment used to mine Wyo-Ben, Inc.'s bentonite pits include Caterpillar D-8 to D-10 dozers, Caterpillar 627 and 637 scrapers, excavator/rock truck systems, and loaders. Scrapers are used to remove overburden from above bentonite beds, move that material to and from spoil and soil stockpiles or the previous phase of mining, and extract bentonite from exposed bentonite beds. Dozers are also used to remove overburden from above bentonite beds, and move material between pit phases during backfill and countering operations of castback mining. Excavator/rock truck systems are used to extract and move bentonite to stockpiles from narrow beds, and remove and move overburden from steep beds when other mine equipment is not practical. Finally, loaders are used in bentonite stockpile areas to load bentonite into haul trucks for removal to processing plants. Other equipment not mentioned above may be used when conditions dictate their use.

RECLAMATION PLAN

The reclamation/revegetation process will be designed to restore a mosaic vegetation scheme consisting of site specific dominance of various life forms (shrubs, grasses, and forbs) with a diverse species composition. Additional revegetation goals include site stabilization/erosion control and visual aesthetics. Land use restoration goals include wildlife habitat and livestock grazing.

Reclamation backfill will be achieved during the castback mining process using variously sized Caterpillar tractor-scrapers depending on availability. Wyo-Ben, Inc.'s mining contractors typically use Caterpillar 627 and 631 tractor-scrapers. These are supplemented with Caterpillar tractor-dozers ranging from D-8 to D-10 in size, used for backfilling and contouring. Most drainage construction will be done with a backhoe excavator.

Final reclamation contours will be consistent with those necessary to reestablish the projected postmining land use goals of domestic livestock grazing and wildlife habitat. Final slopes and surface contours will approximate native gradients and will blend with adjacent topography. Typically, due to relatively thin bentonite beds, and swell of displaced overburden, final contoured and reclaimed grade that equals native grade is achievable. Through drainage will be reestablished in all backfilled phases. Ephemeral channels to be impacted by this proposed mining activity will be temporarily directed around open pits during active mining stages. Channel design for both temporary and permanent diversions will match premine channel gradients and cross-sectional shapes. Temporary diversions will comply with Noncoal rules, section 2(e)(ii)(F) to allow passage of peak runoff from a 2 year, 6 hour precipitation event in a nonerosive manner. Permanent diversions (including reconstructed channels and adjacent topography) will comply with Noncoal rules, section 2 (e) (iv), to be erosionally stable during the passage of the peak runoff from a 100 year, 6 hour precipitation event.

Reclamation backfill will follow the castback mining sequence illustrated in Figure MP-2 in the Mine Plan Section. Following backfilling and contouring, all compacted surfaces will be ripped to improve water infiltration and retention. Subsoil and topsoil will be replaced from stockpiles or hauled directly during the castback mining sequence. Average topsoil and subsoil redistribution depths are reported in Table D-7.5. Where necessary on initial pit cuts, out-of–pit overburden stockpiles will be contoured in-place and used for temporary bentonite and soil stockpile locations (C.O.P. locations on the Mine Plan Map). Final reclamation of these areas will include deep-ripping, spreading topsoil/subsoil and seeding.

Wyo-Ben, Inc. will begin backfill no longer than two years after any lands are affected; and those lands will be reclaimed through seeding no longer than fours years after disturbance unless an interim stabilization plan has been approved. A three-year backfill/five-year final reclamation schedule will be followed in areas where field drying of mined material is occurring.

Wyo-Ben, Inc. will consider alternative innovative techniques for reclamation in order to achieve bond release. Some of these innovative techniques may include pitting, broadcasting, drilling, or hydro-seeding, the crimping of straw, candy-striping of soil, or mosaics of deeper soil where there is little to spread, seed coating, additives to the soil (including but not limited to mycorrhizae, boron, gypsum, limestone, fertilizers, mulch, grass clippings, wood chippings, weed free manure/compost, polymers, sugar), sagebrush seedlings, fencing, spraying of invasive species before and/or after mining, alternative irrigation techniques, alternative seed mixtures which may include approved non-native species, or other methods that will require BLM and DEQ approval prior to application.

Drill-Hole Plugging

All drill holes are filled with overburden that is augured out of the hole during the drilling process immediately after the intended drill sample has been obtained. Top and subsoil is placed back on top to allow the regrowth of native vegetation .

Feasibility of Pit Backfill

As previously mentioned, Wyo-Ben utilizes a castback mining procedure when stripping pits. This method of mining is both economical and environmentally compatible. The fact that overburden is handled only once in the process of material movement during the stripping and reclamation process is an economical method of mining. Also, using the castback method allows reclamation to stay concurrent with mining as backfilling and contouring of a previous phase is occurring at the same time the current phase of a pit is being stripped. Finally, moving material between phases of a pit is safer than pushing it laterally into the open hole over the highwall.

Isolation and Control of Acid-Forming, Toxic, or Deleterious Material

Wyo-Ben, Inc. characterizes the overburden from the surface down to the bentonite in each pit it plans to mine at a rate of approximately 1 hole per mile of proposed pit (reported in D-5). In this process, a material sample is obtained every five feet down to the bentonite and sent to Intermountain labs in Sheridan, Wyoming for testing of chemical and physical parameters. If it is shown that a particular pit has the potential for acidic, deleterious or toxic material near the surface, Wyo-Ben will attempt to cover it with at least two feet of a more neutral spoil material from adjacent pits in a lateral castback procedure, or bury that layer deeper in the profile during backfill. If deleterious material (bentonite, spoil) is intentionally placed on the surface, it will be bermed to prevent off-site sedimentation of the material.

In the situation of unintentional placement of deleterious materials on native lands (i.e. a large bentonite spill) Wyo-Ben will remove the deleterious material from the lands as soon as possible and reseed the disturbed area with an appropriate seed mixture.

Post Closure Management

Wyo-Ben monitors all its reclaimed lands post closure for off-site sedimentation, erosion and seeding failures. Off-site sedimentation is controlled by installation of straw bail or fabric check dams into affected drainages. If unacceptable erosion is detected, it is repaired at the first available opportunity. Repair in the past has mostly been accomplished by reconstructing the drainage and lining it with erosion control fabric, rock, or installation of rock gabions. Finally, seeding is monitored on a regular basis. If after two to four growing seasons vegetation establishment is not adequate, Wyo-Ben will determine the reason for failure and mitigate the problem including reseeding of the site.

Revegetation Techniques and Seed Mixtures

Revegetation considerations include use of the area for domestic livestock grazing and wildlife habitat. Revegetation procedures will begin following contouring and topsoiling of the disturbed areas as previously described.

Seedbed preparations may include deep-ripping after soil replacement to break up the surface and loosen the soil. Additional surface manipulations such as deep parallel furrows or pitting may be used to enhance moisture harvesting capacities of the areas receiving seed. Seed mixtures will be broadcast seeded. In general, seeding will be conducted in the fall and early winter (prior to freeze-up) to take full advantage of fall, winter and spring moisture. From time to time, we may exercise our discretion to attempt spring seeding on areas where live topsoil has been directly placed during winter months to reduce destruction of native species volunteering during the first growing season and prior to what would be the fall seeding period. Because negative grazing impacts may affect the success of newly seeded areas, Wyo-Ben may choose to fence reclaimed areas until the established vegetation community can support regulated grazing.

Reclamation of haul roads will be accomplished by contouring to restore drainage patterns, remove culverts, and blend with surrounding topography. These areas will then be deep-ripped, subsoiled/topsoiled and seeded.

Composition of the proposed seed mixture is detailed below. Use of all species depends on seed availability in the year of seeding.

Seed Species	Rate-lb PLS/acre
Gardner saltbush (*A. gardneri*)	4.0
Fourwing saltbush (*A. canescens*)	4.0
Rubber Rabbitbrush (*Chrysothamnus nauseosus*)	2.0
Wyoming Bigsagebrush (*Artemisia tridentata*)	2.0
Indian ricegrass (*Oryzopsis hymenoides*)	2.0
Bottlebrush squirreltail (*Sitanion hystrix*)	0.5
Sandberg bluegrass (*Poa sandbergii*)	0.5
Bluebunch Wheatgrass (*Pseudoroegneria spicata*)	1.0
Sand Dropseed (*Sporobolus cryptandrus*)	0.5
Rocky Mountain Bee Plant (*Cleome serrulata*)	0.5
Annual sunflower (*Helianthus annuus*)	0.5
Lewis Blueflax (Linum Lewisii)	0.5
	18.0 lb/acre

In areas where significant sagebrush communities are disturbed, they will be targeted to be reclaimed to sagebrush habitat by increasing the rate of sagebrush seed to 3 lbs/acre. Other species may be seeded separately based on soil quality and topographic features including basin wildrye (*Elymus cinereus*) broadcast onto uplands and reconstructed drainages and other low-lying areas at a rate of 0.5 to 2 pounds per acre, and Fringed Sagewort (*A. frigida*) at a rate of 0.5 to 1.0 pounds per acre. Monitoring of past reclamation successes and failures may influence seed mixture composition and surface preparation techniques.

Quality Assurance

Wyo-Ben utilizes two drill trucks to characterize the volume and quality of bentonite in the various beds during the development of pits. This allows us to tighten planned disturbance boundaries of our pits, which in many cases, reduces the amount of disturbance that would otherwise occur. Soils of proposed mine areas are characterized to an order 2 level. This allows us to determine the quality and volume of soils that can be saved to produce quality reclamation. As stated previously, Wyo-Ben commits to save all available top and subsoil for reclamation during the initial stripping part of the mining process, and will either stockpile or spread it live. The stripping of pit phases is accomplished using a castback mining procedure. This practice allows reclamation to be concurrent with mining. Typically, previously mined phases of a pit are reclaimed through backfilling and contouring almost adjacent to the open phase of a pit, with soiled and seeded phases not far from this. Before a pit is backfilled, bentonite cleanings are pushed against the bottom of the highwall to ensure they will be buried deep. In the reclamation of bentonite stockpile areas, the pad (portion of bentonite near the bottom of a stockpile that is not used) is buried, followed by the ripping and soiling of the area. All compacted areas, such as roads and other stockpile areas are also ripped prior to soiling to reduce compaction. The movement of overburden during the mining process is done in a tiered castback process, which places material from the current phase of mining into a previous open pit in approximately the same order as it was removed. This process is employed unless overburden testing reveals the need to place at least two feet of neutral spoil material over a toxic layer near the surface (i.e., very high SAR or acid potential).

Mine Plan Supplemental Information

Stockpiles as shown on the Material Flow Diagram will follow the below described reclamation schedule:
There are three general mine areas of the proposed pit 108T ext, with their illustrated stockpile areas, those being the west area containing phases 1 through 13, the middle area containing phases 14 through 31, and the east area containing phases 32 through 50. Phase 51 is a lone pit that does not fit into any castback mine sequence. It will be mined sometime during the mining of the middle area.

West Area

A portion of current pit 108T will be left as backfilled, but not soiled and seeded to act as a long term stockpile area that will accommodate all bentonite stockpiles for the life of that section of the west portion of pit 108T ext. That stockpile area will be reclaimed within two years after phase 13 of 108T ext. has been reclaimed.

Middle Area

C.O.P 1 area will be open for equipment staging (campsite) and as a bentonite and soil stockpile area. This area will remain open as a campsite/stockpile area during the mining of phases 14 through 23 and 51, after which it will be reclaimed within two years. A stockpile area will be built on backfilled phases of the middle mine area, roughly in the phase 22-24 area, to accommodate bentonite stockpiles for the remaining phases of the middle area once C.O.P 1 is no longer in use. That stockpile area will be in place until phase 31 is mined and reclaimed, and should be reclaimed within two years after phase 31 is reclaimed. T.O.P 1 will be used almost exclusively as a topsoil and subsoil stockpile area, and will be open in various locations throughout the length of mining in the middle area. It will be reclaimed within one year after phase 31 is reclaimed.

East Area

T.O.P 2 will remain active throughout mining of all phases of the east portion of pit 108T ext. It will be reclaimed within two years of reclamation of the last phase of the east portion of the pit.

BOND CALCULATIONS

Reclamation bonding assessments have been calculated for the projected first year's mining activity anticipated with this application (Table RP-1). Wyo-Ben, Inc. updates and adjusts its overall Reclamation Bonding liability each May 1 with the Annual Report for Wyoming Mining Permit 321C.

The calculations presented in Table RP-1 make the following assumptions.

PITS

Overburden: If necessary, backfill can be achieved using material from associated contoured out- of-pit overburden stockpiles (C.O.P.) and/or highwall reductions.

Topsoil: If necessary, topsoil/subsoil redistribution can be achieved using material from associated topsoil/subsoil stockpiles. Topsoil and subsoil is calculated for the initial 3 phases only; after which it is anticipated soils will be spread live in the castback process.

Seeding: Seeding costs are calculated using $500/acre times the total proposed disturbance area.

TABLE RP-1. BONDING SUMMARIES FOR PIT 108T EXTENSION

PIT NUMBER/ SEQUENCE	TOPSOIL & SUBSOIL REPLACEMENT (YD^3)	OVERBURDEN REPLACEMENT (YD^3)	GRADING COST PER ACRE	SEEDING COST PER ACRE	TOTAL BOND REQUIREMENT
Current Rates	**$0.83/CY**	**$0.83/CY**	**$60.00**	**$500.00**	
108T Ext. Frontier 3 Bed	**4,700 yd^3 + 18,500 yd^3** **23,200 yd^3**	**70,400 yd^3**	**5.8**	**5.8**	
(Assumes first year mining of three phases)	**$19,256**	**$58,432**	**$350**	**$2,900**	**$80,938**

Total Calculated First Year Reclamation Bonding Requirement	**$80,938**
Surcharge @ 25.0%	**$20,234**
Total Pit Bonding Requirement	**$101,172**

Proposed Haul Roads: No new haul roads will be constructed the first year

These reclamation bonding costs were developed using the following assumptions:

Ripping the roadbed and recontouring using a motor-grader
2 hours per acre @ $60 per hour

Drainage establishment using a front-end loader or track-hoe:
1 hour per acre @ $75 per hour

Topsoil redistribution using a self-loading scraper:
1.5 hours per acre @ $110 per hour

Seeding @ $500 per disturbance acre

Total Estimated Reclamation Costs per Acre:	**$860**
Total Proposed Haul Road Disturbance Acreage:	**0.0**
Total Reclamation Bonding requirement for Haul Roads	**$0.0**
Surcharge @ 25%	**$0.0**
Total Haul Road Bonding Requirement	**$0.0**

<u>FIRST YEAR GRAND TOTAL RECLAMATION BONDING REQUIREMENTS FOR PITS, C.O.P., AND ROADS:</u>

Total Pit Bonding Requirement	**$101,172**
Total Haul Road Bonding Requirement	**$0.0**
Grand Total	**$101,172**
Anticipated First Year Bonded Acres on Federal Lands:	**5.8 Acres**
Anticipated First Year Bonded Acres on State and Private Lands:	**0.0 Acres**